

FORT SILL, OKLAHOMA

TERRAIN ANALYSIS



PREPARED BY
DAMES AND MOORE, WASHINGTON, D.C

UNDER THE DIRECTION OF
THE TERRAIN ANALYSIS CENTER
US ARMY ENGINEER TOPOGRAPHIC LABORATORIES
FORT BELVOIR, VIRGINIA 22060

DECEMBER 1980

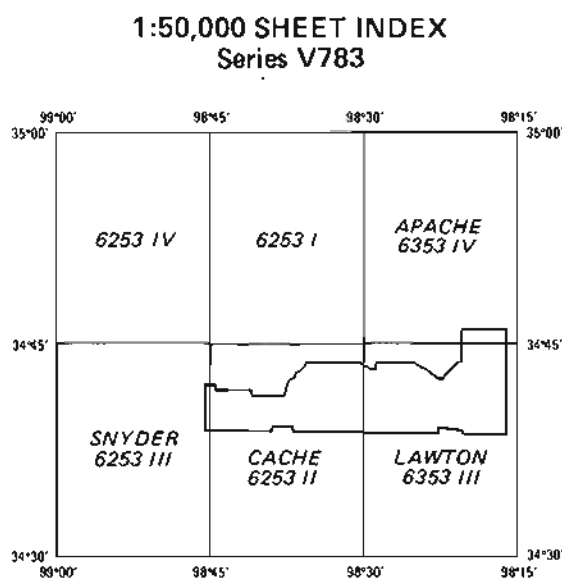
Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE DEC 1980		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Fort Sill, Oklahoma Terrain Analysis				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Terrain Analysis Center U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 48	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

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CONTRACT NUMBER DACA 87-80-C-0116

DECEMBER 1980

etba

I. INTRODUCTION

BACKGROUND

The requirement for this terrain analysis of Fort Sill was validated by the Assistant Chief of Staff for Intelligence, Department of Army, included in the five-year Terrain Analysis Program, and assigned as part of the program element, "Terrain Analysis of Selected CONUS Army Installations." Responsibility for management and supervision of this program element developed in response to FORSCOM and TRADOC requirements, was assigned to the Terrain Analysis Center (TAC), U.S. Army Engineer Topographic Laboratories. TAC responsibility also included technical supervision and direction of designated troop units assigned to the program.

Scope and content of the topical coverage included in the terrain analyses of selected CONUS installations were developed jointly between representatives of TAC and FORSCOM, and later concurred in by TRADOC.

This study was prepared by Dames & Moore, Washington, DC (Contract No. DACA 87-80-C-0116) under the direction of TAC.

PURPOSE

The major purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes among other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies.

Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These items are also treated in the studies.

Because the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. Some of the information contained in the studies may be useful as environmental baseline data, but the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments.

SCOPE

In scope, the terrain analysis is a compendium of available data on the pertinent natural and manmade features of the reservation and an evaluation of their effects on tactical military operations. The program does not include basic research to fill gaps in these data although some short term field investigations were performed to obtain ground truth and a general overall appreciation of terrain elements. Therefore, the scope of the analysis is limited primarily to those factors which have been documented by other authorities and to the results of analysis and evaluation of those factors by senior terrain analysts for topics such as cross-country movement, cover and concealment, and water resources.

The terrain analysis preparation process has necessarily involved analytical judgment in the selection of pertinent source data, resolution of data conflicts, recognition of interrelationships not previously made explicit, and the application of remote sensing to update certain critical, time-variant data such as vegetative cover and manmade features including roads, airfields, and facilities constructed outside of the cantonment areas.

LIMITATIONS

The study naturally reflects limitations in the quality, amount, and currency of the source data on which it is based. Numerous field interviews and selective use of remote sensing were employed in an effort to assure presentation of the latest and best information. Within the relatively complex topical scope of the analysis, however, there are a number of aspects on which source data have not been generated with the focus or recency desired to meet objectives fully. As noted under Scope, the study effort was not designed to include basic research as a means of filling gaps in data.

By design, the presentation is cast at a level of data coverage consistent with stated objectives. Users interested in deeper pursuit of data are referred to the List of Sources in the back of the study.

PRESENTATION

Maximum use of graphic presentation has been made throughout the terrain analysis. Supporting text is, as far as practicable, in tabular format keyed to the related graphics which follow. The primary map scale is 1:50,000. For Urban Area (Cantonment Area), the scale of the map is 1:14,400 and for Off-Post Features the map scale is 1:1,000,000.

STUDY AREA

The Fort Sill military reservation is in southwestern Oklahoma, approximately 161 kilometers (100 miles) southwest of Oklahoma City. The reservation extends approximately 13 kilometers (8 miles) north-south at its widest point and 37 kilometers (23 miles) east-west, and covers an area of approximately 38,460 hectares (95,000 acres). Fort Sill lies entirely in Comanche County. U.S. Highways 62, 277, and 281 merge into a single north-south right-of-way through the eastern part of the reservation.

The Fort Sill military reservation lies within the Osage Plains section of the Central Lowland Province. The eastern and western parts of the reservation are gently to moderately rolling, partially dissected upland plains of low to moderate relief. The Wichita Mountains, a deeply dissected granite upland or erosional remnant, characterized by steep slopes, moderate relief, and rounded hills, occupy the central portion of the reservation. The highest elevation is 673 meters (2207 feet) on Mount Sherman in the west-central part of the reservation. The lowest elevation is 329 meters (1080 feet) in the flood plain of East Cache Creek at the southeast boundary of the reservation. Major streams on Fort Sill flow generally south-southeast, draining into Cache Creek approximately 19 kilometers (12 miles) south of the reservation.

The climate of the area is temperate with warm, fairly dry summers and mild winters. The mean annual precipitation is about 79 centimeters (31 inches); the highest amount of precipitation occurs in the spring and early fall. Spring is also the most variable season, characterized by severe local storms and tornadoes. Vegetation varies from tall grass prairie with scattered fringes of mesquite and scrub oak to dense forests in flood plains and along the edges of the Wichita Mountains.

II. DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

A. SURFACE CONFIGURATION

Fort Sill lies in the Osage Plains section of the Central Lowland Province. Topography characteristic of this section is found in the eastern and western portions of the reservation. The Wichita Mountains occupy the central portion of the reservation.

The western and eastern portions of the reservation are nearly level to gently rolling, partially dissected low plains with low relief.

High plains in the north-central part of Fort Sill are moderately to strongly rolling, locally deeply dissected uplands of moderate relief. Gently to moderately rolling high plains in the eastern and western portions of the reservation are also characterized by moderate relief; however, this upland surface is not as deeply dissected as is the north-central area.

The central part of Fort Sill is predominantly deeply dissected, moderately rolling to steeply sloping low hills. Sharp ridges, rounded crests, and rocky surfaces characterize this granitic upland.

LANDFORM TYPE	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATIONS
1. Low plains	<p>Nearly level to gently rolling terrain characterizes much of the western portion of Fort Sill. Post Oak, Rock, and West Cache Creeks, the principal drainageways in this portion of the reservation, flow south-southeast. Slopes are generally less than 3 percent near the southern reservation boundary and adjacent to West Cache Creek; slopes are predominantly between 3 and 8 percent throughout the remainder of the area. Local relief is generally between 30 and 40 m (98 and 131 ft).</p> <p>In the central portion of the reservation, nearly level to gently rolling plains occupy areas adjacent to Crater, Blue Beaver, and West Branch Wolf Creeks, as well as much of the low relief surface along the southern reservation boundary. Slopes are largely between 3 and 8 percent, but drop to less than 3 percent near the south boundary; some slopes may locally approach 30 percent in steep stream valleys. Local relief is predominantly 20 to 30 m (66 to 98 ft).</p> <p>Most of the cantonment area and the eastern portion of Fort Sill are on nearly level to gently rolling low plains. East Cache Creek is the principal drainageway; major tributaries in this area are Medicine, Sitting Bear, Beef, and Wrattan Creeks. Slopes are predominantly less than 3 percent; in a large area east of East Cache Creek slopes are generally between 3 and 8 percent, but in some local areas approach 15 percent. Local relief is generally between 20 and 30 m (66 and 98 ft).</p>	<p>Elevations in the low plains range largely between 350 and 430 m (1150 and 1410 ft) above sea level. The lowest elevation on the reservation, approximately 329 m (1079 ft), occurs along East Cache Creek near the southern reservation boundary (grid reference 586332). The highest elevation in this unit, approximately 466 m (1528 ft), occurs in the upper part of Rock Creek drainage basin (grid reference 263380).</p>
2. High plains	<p>Discontinuous, gently to moderately rolling uplands extend across the north reservation boundary in the western part of Fort Sill. Much of the upland plain is deeply incised by tributaries of Post Oak, Rock, and West Cache Creeks. Slopes are largely between 8 and 15 percent; however, slopes often exceed 45 percent in the narrow, dissected stream valleys and may locally exceed 100 percent for rocky escarpments along West Cache Creek. Slopes on Quanah Mountain (grid reference 324376) are predominantly between 30 and 45 percent. Local relief is largely between 50 and 70 m (164 and 230 ft); maximum local relief is approximately 120 m (394 ft).</p> <p>Moderately rolling and locally deeply dissected uplands predominate along the north reservation boundary in the central portion of Fort Sill. Carlton Mountain, Gruber Hill, and McKenzie Hill, in the south-central part of the reservation, are also steep, dissected high plains. Deer and Brush Creeks, east-flowing tributaries of Medicine Creek, are the principal drainageways; Deer Creek is locally deeply incised (grid reference 454415). Slopes are largely between 15 and 30 percent, occasionally exceeding 45 percent in narrow stream valleys and 100 percent on short sidehill slopes. Local relief is predominantly between 40 and 110 m (262 and 361 ft); maximum local relief is approximately 130 m (426 ft) near Carlton Mountain (grid reference 440374).</p> <p>Small areas of gently to moderately rolling high plains are scattered north and east of the cantonment area. Most of these uplands are local drainage divides. Slopes are predominantly between 8 and 15 percent; however, slopes may exceed 45 percent locally. Vertical slopes occur at Medicine Bluffs escarpment (grid reference 535380). Local relief is largely between 60 and 70 m (197 and 230 ft); maximum local relief is approximately 140 m (459 ft) near Rabbit Hill (grid reference 502419).</p>	<p>Elevations in the high plains range largely between 380 and 480 m (1246 and 1574 ft) above sea level. The lowest elevation, approximately 342 m (1122 ft), occurs along Medicine Creek near Medicine Bluffs (grid reference 543379). The highest elevation, approximately 553 m (1814 ft), is on Costain Hill (grid reference 381422).</p>
3. Low hills	<p>Moderately to strongly rolling low hills dominate the west-central portion of Fort Sill and Signal Mountain (grid reference 467368). These hills have steep, rocky slopes, sharp ridge flanks, and somewhat rounded crests. Slopes are largely between 30 and 45 percent; however, slopes may exceed 60 percent locally, particularly in narrow valleys. Local relief is predominantly between 180 and 220 m (590 and 722 ft); maximum local relief, approximately 250 m (820 ft), occurs near Mount Sherman (grid reference 383384).</p>	<p>Elevations in the low hills range largely between 420 and 620 m (1378 and 2034 ft) above sea level. The lowest elevation, approximately 380 m (1246 ft), occurs near Scorpion Ridge (grid reference 480364). The highest elevation on Fort Sill, approximately 673 m (2207 ft), occurs on the summit of Mount Sherman (grid reference 383384).</p>

B. SURFACE DRAINAGE

Fort Sill lies within the Red River drainage basin. More than 90 percent of the reservation is part of the Cache Creek basin; only the extreme eastern portion of the base drains into Beaver Creek. Primary streams in the east-central portion of the reservation are East Cache Creek and three tributaries, Sitting Bear, Beef, and Medicine Creeks. Blue Beaver, West Cache, and Post Oak Creeks are the principal streams in the western portion of the reservation. Many of the streams have headwaters in the Wichita Mountains and flow south-southeast across Fort Sill to Cache Creek, eventually reaching the Red River approximately 55 kilometers (34 miles) south of the reservation. The Red River then flows southeast to the Mississippi River north of Baton Rouge, Louisiana.

Streamflow on Fort Sill is likely to be highest in May and June, the wettest time of year. East Cache and Medicine Creeks are perennial streams, carrying water during most of every year; other streams are seasonal or ephemeral, flowing during the spring rainy season or following storms. Though storms may occur throughout the year, those in the spring and the month of October are most likely to produce significant streamflow. Conversely, January and February are the driest months. As the flow decreases, shallow pools form in many streams; these pools slowly evaporate or percolate into the ground. Thin ice may form on these pools during very cold winters, but usually does not last more than several days.

There are no streamflow gages on Fort Sill. The nearest gage is 1.6 kilometers (1 mile) south of the reservation on Blue Beaver Creek at old U.S. Highway 62 near Cache and has been operated since July 1964. A gage on East Cache Creek near Walters, Oklahoma, approximately 30 kilometers (18.6 miles) south of the reservation, has a period of record from May 1938 to December 1963 and from October 1969 to the present. Discharge information from these gages is contained in the Drainage Characteristics table shown below. Flood discharge information given below was calculated using techniques developed by the U.S. Geological Survey. No flood discharges were estimated for East Cache or Medicine Creeks due to upstream control by Lake Ellsworth, Lake Lawtonka, and Elmer Thomas Lake.

The lack of surface streamflow much of the year has brought about the improvement of many stream crossings as fords rather than bridges. There are 38 fords given in the table below; all but one are concrete lined and many have pipes or channels built into them to carry low to normal flow. Pools are commonly formed upstream of the fords, as these are often the widest and shallowest parts of the stream. During high flow, the high velocity of most Fort Sill streams makes fording hazardous to impossible at most locations. Many fords have staff gages, marked in feet, to indicate the depth of flow across the ford; at these locations, depths over 1 meter (3 feet) should be considered hazardous for all but tracked vehicles. In addition to the locations given below, there are an undetermined number of "dry fords" on the reservation where streams can be crossed most of the year even though no improvements have been made. Trafficability at unimproved fords is reduced following streamflow due to wet soils and possible obstructions in the channel. Though all improved fords are suitable for all vehicles, access to many is limited to four-wheel drive and tracked vehicles due to poor road conditions following rainfall.

There are 58 lakes and reservoirs listed in the table below. Four of these reservoirs are formed behind stone masonry dams; the remainder are behind earth dams. Reservoirs provide water for wildlife and firefighting as well as some erosion control. In addition to the reservoirs listed below, there are approximately 166 small reservoirs on Fort Sill which have not been tabulated, but are used for wildlife, firefighting, and erosion control. Reservoirs included in the table were selected based upon size and use. Elmer Thomas Lake, the largest lake on Fort Sill, is shared with the Wichita Mountains National Wildlife Refuge, for which it is the primary water supply.

Although many of the reservoirs on Fort Sill provide some degree of flood control, the only structure designed expressly for this purpose is a levee near Sitting Bear Creek (grid reference 552361). This earth levee, approximately 1.5 to 3 meters (5 to 10 feet) high, provides flood protection for several buildings in the cantonment area. Channel improvements and concrete lining of portions of Sitting Bear Creek were designed to control erosion, but also afford the cantonment area some flood protection.

B. SURFACE DRAINAGE (Continued)

DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORY	GENERAL	REGIME	WIDTH	DEPTH	VELOCITY AND DISCHARGE	BANKS	BOTTOM
WATERCOURSES							
East Cache Creek	Perennial stream occupies an incised and tortuously meandering channel in a broad alluvial plain. Drains most of east-central Fort Sill. Overbank areas are densely vegetated. Several meanders east of the cantonment area have been cut off and used as fill areas. Flows south-southeast to Red River approximately 55 km (34 mi) south of Fort Sill.	High water, May through June; low water, remainder of year. Locally intense storms occur March through November. Flood waters rise rapidly, but flooding is of short duration.	Generally between 5 and 10 m (16 and 33 ft), but varies greatly, exceeding 15 m (50 ft) in many pools. In high water, could exceed 30 m (100 ft).	Generally less than 1 m (3 ft). In high water, could exceed 4 m (13 ft).	Velocity is generally fairly low but rises quickly with water level. Flow is partially regulated by Lakes Lawtonka and Ellsworth. At Walters gage, maximum discharge for period of record was 799 m³/sec (28,200 ft³/sec) on 18 May 1951. No flow occurred at times in 1939 and 1940, however, sewage effluent from Lawton and Walters would now sustain flow. Average discharge is 4.7 m³/sec (166 ft³/sec).	Clay, mostly 5 to 8 m (16 to 26 ft) high and steep, generally exceeding 45°. Broad alluvial plain extends above channel.	Clay, sand, and gravel. Gradient is gentle, approximately 1 m/km (5 ft/mi).
Sitting Bear Creek	A tributary of East Cache Creek, this small, ephemeral stream drains most of the cantonment area. Much of the channel between Currie Road and U.S. Highways 62, 277, and 281 has been straightened and concrete lined.	High water follows intense, local precipitation, with water rising and falling quickly. Wash rack effluent and other outdoor water uses cause this normally ephemeral stream to flow year-round.	Generally 3 to 4.6 m (10 to 15 ft); in high water, could exceed 10 m (33 ft).	Generally less than 0.5 m (1.5 ft); in high water, could exceed 2 m (7 ft) in channel.	Velocity and discharge are generally very low, but both rise quickly following rainfall due to the development in the basin.	Clay and gravel, mostly less than 1.5 m (5 ft) high and steep, exceeding 45°. Near its confluence with East Cache Creek, heights approach 6 m (20 ft). Height is approximately 1.5 m (5 ft) where channel is improved.	Clay and gravel except where concrete lined.
Beef Creek	Seasonal stream occupies a narrow incised channel. Drains most of north-east portion of reservation, flowing southwest to join East Cache Creek.	High water, May through June and following intense or extended rainfall. Low water throughout much of the year. Flow rises and falls quickly following precipitation.	Generally 3 to 4.6 m (10 to 15 ft) below and less than 3 m (10 ft) above Frisco Creek. In high water, could exceed 15 m (50 ft).	Less than 1 m (3 ft); in high water, could exceed 3 m (10 ft) in channel.	Velocity and discharge are low, both rising quickly following precipitation. During high water velocity would be high but flow would be of short duration. No flow at times each year.	Clay ranging from 1.5 to 5 m (5 to 16 ft) in height and near vertical.	Clay with a gentle gradient, approximately 4 m/km (21 ft/mi).
Medicine Creek	Perennial stream occupies a narrow channel in a valley, which varies greatly in width from broad to narrow and steep-sided; flows at the base of the Medicine Bluffs escarpment. Southeast flowing tributary of East Cache Creek.	High water May through June. Flow is low much of year, and is regulated by discharge from Lake Lawtonka and Elmer Thomas Lake.	Generally between 6 and 10 m (20 and 33 ft), but varies greatly exceeding 15 m (50 ft) in numerous pools. In high water, could locally exceed 60 m (200 ft).	Less than 1 m (3 ft) except up to 2 m (7 ft) in some pools. In high water, could locally exceed 4 m (13 ft) in channel.	Velocity is low and discharge depends upon release from Lake Lawtonka. Moderate velocity and discharge could occur following rainfall in small, uncontrolled tributary basins.	Varies from sand and gravel in upper reaches to clay near cantonment; generally 1 to 3 m (3 to 10 ft) in height and exceeding 45°.	Clay, sand, and gravel with a gentle gradient, approximately 3 m/km (16 ft/mi).
Deer Creek	Small stream in a narrow, incised channel, ephemeral in its upper reaches, seasonal in lower reaches. East flowing tributary of Medicine Creek has cut new channel along road in places.	High water May through June. Flow is low much of year, and is regulated by discharge from Lake Lawtonka and Elmer Thomas Lake.	Generally less than 3 m (10 ft) above grid reference 445415, 3 to 6 m (10 to 20 ft) below. In high water, 7 to 10 m (23 to 33 ft).	Less than 0.5 m (1.5 ft); in high water, could exceed 2 m (7 ft) in channel.	Velocity is moderate and discharge low. Following rainfall, velocity would be very high and discharge moderate but flow would be of short duration. No flow at times each year.	Sand, gravel, and, locally, rock, 1.5 to 4 m (5 to 13 ft) high and near vertical.	Sand and gravel with a high gradient, approximately 12 m/km (63 ft/mi).
Blue Beaver Creek	Seasonal stream in a shallow channel which is locally braided. South-southeast flowing tributary of West Cache Creek. Bounded by escarpment just below Ketch Lake. Dense vegetation along and in the channel.	Same as Deer Creek.	Generally 4 to 8 m (13 to 26 ft). In high water, may exceed 50 m (165 ft).	Less than 0.5 m (1.5 ft); in high water, 1 to 3 m (3 to 10 ft).	Velocity is moderate and discharge low. Following rainfall, velocity very high and discharge high. At Cache gage, maximum discharge for period of record was 385 m³/sec (13,600 ft³/sec) on 28 August 1977. No flow at times each year. Average discharge is 0.26 m³/sec (9.30 ft³/sec).	Sand and gravel, 0.5 to 2 m (1.5 to 7 ft) high; near vertical where high, almost non-existent where low.	Sand and gravel with a moderate gradient, approximately 7 m/km (37 ft/mi).
West Cache Creek	Seasonal stream flows south-southeast in a sinuous channel with many wide pools. Overbank areas are densely vegetated. Streams in the western part of Fort Sill are tributaries of West Cache Creek which itself flows into East Cache Creek near the Red River.	Same as Deer Creek.	Generally 5 to 8 m (16 to 26 ft), but may exceed 15 m (50 ft) in pools. In high water, may exceed 50 m (165 ft).	Varies from 0.5 m (1.5 ft) where flowing to 1.5 m (5 ft) in pools. In high water, could exceed 3 m (10 ft) in channel.	Generally, velocity is low to moderate and discharge is low, however, both rise quickly following rainfall. High flows are of short duration. No flow at times each year.	Sand and gravel, 1.5 to 6 m (5 to 20 ft) high and near vertical.	Sand and gravel with a moderate gradient, approximately 7 m/km (37 ft/mi).
Post Oak Creek	Seasonal stream in the southwest corner of Fort Sill, flows south-southeast in a sinuous channel with many pools. Overbank areas are densely vegetated.	Same as Deer Creek.	Generally 5 to 9 m (16 to 30 ft), but may exceed 15 m (50 ft) in pools. In high water, may exceed 30 m (100 ft).	Less than 0.5 m (1.5 ft); in high water, could exceed 2 m (7 ft).	Same as West Cache Creek.	Sand and gravel, 1 to 2.5 m (3 to 8 ft) high and steep, exceeding 45°.	Sand and gravel with a gentle gradient, approximately 4 m/km (21 ft/mi).
Other Streams	Small ephemeral tributaries found across Fort Sill. Many, particularly below small dams, are locally incised. Dense vegetation occurs along and in the channels.	Flow for brief periods following intense or extended rainfall, particularly May through June.	Generally 1 to 3 m (3 to 10 ft). In high water, may locally exceed 5 m (16 ft) and cause some flooding.	Generally less than 0.5 m (1.5 ft), may reach 1 to 2 m (3 to 7 ft) at peak flows.	Velocity is moderate to very high when flowing, but streams are dry much of every year. Discharge is moderate and duration of flow is brief.	Primarily sand and gravel in the west and north-central parts of Fort Sill, becoming clay in the east and south.	Variety of gravel, sand, and clay, becoming finer in texture from west to east. Gradients are moderate to high.
STANDING BODIES OF WATER							
Reservoirs (See table below.)							

B. SURFACE DRAINAGE (Continued)

RESERVOIRS

MAP NUMBER	NAME	GRID REFERENCE	APPROXIMATE SURFACE AREA AT CAPACITY		CONSTRUCTION AND USE*
			hectares	(acres)	
W1	Wichita	251349	0.6	(1.6)	
W2	Chippewa	266355	1.0	(2.5)	
W3	Jackson Hole	296330	2.4	(6.0)	Fishing.
W4	Tecumseh	327337	1.2	(3.0)	Waterfowl.
W5	Potawatomi Twins-upper	329352	0.8	(2)	
W6	Potawatomi Twins-lower	329348	4.5	(11)	
W7	Upper Canyon	341372	1.6	(4.0)	Stone masonry; Camp Eagle water supply.
W8	Lower Canyon	341369	0.2	(0.5)	Stone masonry; Camp Eagle water supply.
W9	Osceola	346343	2.0	(5.0)	Fishing and recreation.
W10	Three Crows	359330	1.6	(4.0)	Fishing.
W11	Quannah Lake	361373	1.6	(4.0)	Stone masonry; fishing.
W12	Logan	395336	12.5	(31)	Fishing and waterfowl.
W13	Ketch Lake	373403	9.7	(24)	Stone masonry; fishing and recreation.
W14	Engineer	395409	4.2	(10.5)	Fishing and recreation.
W15	Signal	407395	1.6	(4.0)	Fishing.
W16	Thor	405385	1.2	(3.0)	Fishing.
W17	Bobcat	409373	1.6	(4.0)	Fishing.
W18	Unnamed	393370	2.8	(7.0)	Fishing.
W19	Elmer Thomas Lake	440422	191.0	(472)	Principal dam, concrete, is in Wildlife Refuge; provides recreation and supplies water to Wildlife Refuge and Lake Elmer Thomas Recreation Area (LETRA). Center of West Range impact area.
W20	West Lake	454375	8.1	(20)	
W21	Tank X	448334	1.2	(3.0)	Fishing.
W22	Klamond	469332	0.6	(1.5)	Scheduled for enlargement to 4.5 hectares (11 acres).
W23	Creek	477331	0.5	(1.2)	
W24	Upper Strange Dairy	488338	1.4	(3.4)	
W25	Lower Strange Dairy	489336	0.6	(1.6)	
W26	Rocket	505341	0.9	(2.2)	
W27	1976	484412	2.0	(5.0)	Fishing.
W28	Natches	496417	1.6	(4.0)	Fishing.
W29	Snow	548401	1.6	(4.0)	Fishing.
W30	Jump	548396	1.2	(3.0)	Fishing.
W31	Rumbough	524384	0.8	(2.0)	Fishing and recreation.
W32	Owl	547353	0.8	(2.0)	Fishing.
W33	Love	596465	2.0	(5.0)	Fishing.
W34	Quonsett	594453	1.9	(4.8)	Fishing.
W35	Quail	598437	2.8	(7.0)	Fishing.
W36	Frisco Tank	594429	0.8	(2.0)	Waterfowl.
W37	Bluestem	593425	1.2	(3.0)	Fishing.
W38	Menard Tank	627468	0.8	(2.0)	Waterfowl.
W39	O'Connell Tank	633465	1.5	(3.6)	Fishing.
W40	Rudd Tank	620460	1.3	(3.2)	Fishing.
W41	McIntosh	610446	0.8	(2.0)	Fishing.
W42	I-See-O Tank	628403	0.6	(1.4)	
W43	Flagg	595411	1.1	(2.6)	
W44	Upper Wapata	581386	2.0	(5.0)	Fishing.
W45	Lower Wapata	580386	1.2	(3.0)	Fishing.
W46	Bald	585369	2.0	(5.0)	Fishing.
W47	Rattler	586349	2.0	(5.0)	Fishing.
W48	Recon	627343	1.0	(2.5)	
W49	Lake George	603334	36.4	(90)	Fishing and recreation.
W50	Elgin Tank	641448	3.0	(7.3)	
W51	Red	646425	2.0	(5.0)	
W52	Grama	650393	0.8	(2.0)	Erosion control.
W53	Three Awn	648390	1.2	(3.0)	Erosion control.
W54	Potato Hill	648388	0.8	(2.0)	Erosion control.
W55	Clear	656381	1.2	(3.0)	Fishing.
W56	Meadow	656380	1.6	(4.0)	Fishing.
W57	Lark	655343	2.8	(7.0)	Fishing and recreation.
W58	Lake Barrett	650409	8.1	(20)	Firefighting.

*All dams are earthfill unless otherwise noted. Principal design uses are listed where applicable, however, all reservoirs provide water for wildlife and firefighting, as well as some degree of erosion control.

FORDS

MAP NUMBER	GRID REFERENCE	WIDTH		LENGTH		CONSTRUCTION*
		m	(ft)	m	(ft)	
F1	231360	3.0	(10)	18.3	(60)	Slab.
F2	238360	7.3	(24)	12.2	(40)	Slab.
F3	244332	3.7	(12)	36.6	(120)	Slab.
F4	257328	10.1	(33)	33	(108)	Four corrugated metal pipes.
F5	304337	3.7	(12)	6.1	(20)	Slab.
F6	311331	8.5	(28)	15.2	(50)	Two reinforced concrete pipes.
F7	318361	7.3	(24)	13.7	(45)	Four corrugated metal pipes.
F8	320341	7.3	(24)	30	(100)	Slab.
F9	341342	7.3	(24)	24.4	(80)	Two corrugated metal pipes.
F10	360372	3.0	(10)	18.3	(60)	Slab.
F11	357362	7.3	(24)	12.2	(40)	Two reinforced concrete pipes.
F12	374409	7.3	(24)	12.2	(40)	One corrugated metal pipe.
F13	384404	6.1	(20)	12.2	(40)	One corrugated metal pipe.
F14	388404	6.1	(20)	18.3	(60)	Two corrugated metal pipes.
F15	390402	7.3	(24)	18.3	(60)	One corrugated metal pipe.
F16	396403	7.3	(24)	18.3	(60)	Two corrugated metal pipes.
F17	398396	7.3	(24)	18.3	(60)	Two reinforced concrete pipes.
F18	408381	6.1	(20)	30	(100)	Two corrugated metal pipes.
F19	414375	6.1	(20)	18.3	(60)	One reinforced concrete pipe.
F20	410344	7.3	(24)	24.4	(80)	Slab.
F21	409344	7.3	(24)	24.4	(80)	Four corrugated metal pipes.
F22	408330	7.3	(24)	24.4	(80)	Three reinforced concrete pipes.
F23	449418	8.5	(28)	9.1	(30)	Slab.
F24	464416	10.4	(34)	27.4	(90)	Slab.
F25	466415	7.3	(24)	67	(220)	Four corrugated metal pipes.
F26	507384	7.3	(24)	73	(240)	Four corrugated metal pipes.
F27	516392	7.3	(24)	37	(120)	Five corrugated metal pipes.
F28	517400	7.3	(24)	24.4	(80)	Three corrugated metal pipes.
F29	526395	7.3	(24)	9.1	(30)	Slab.
F30	545379					Gravel approaches to unimproved tank trail crossing.
F31	557374	7.3	(24)	110	(360)	Seven corrugated metal pipes.
F32	574378	7.3	(24)	24.4	(80)	Two corrugated metal pipes.
F33	575364	7.3	(24)	38	(125)	Eight reinforced concrete box underflows.
F34	584358	6.1	(20)	13.7	(45)	Two corrugated metal pipes.
F35	531362	6.1	(20)	12.2	(40)	Two corrugated metal pipes.
F36	557359	7.3	(24)	18.3	(60)	Five corrugated metal pipes.
F37	585335	7.3	(24)	38	(125)	Eight reinforced concrete box underflows.
F38	657413	8.2	(27)	13.7	(45)	Slab.

*All fords are concrete unless otherwise noted. The number and type of underflow channels are provided where applicable.

STREAM DISCHARGES

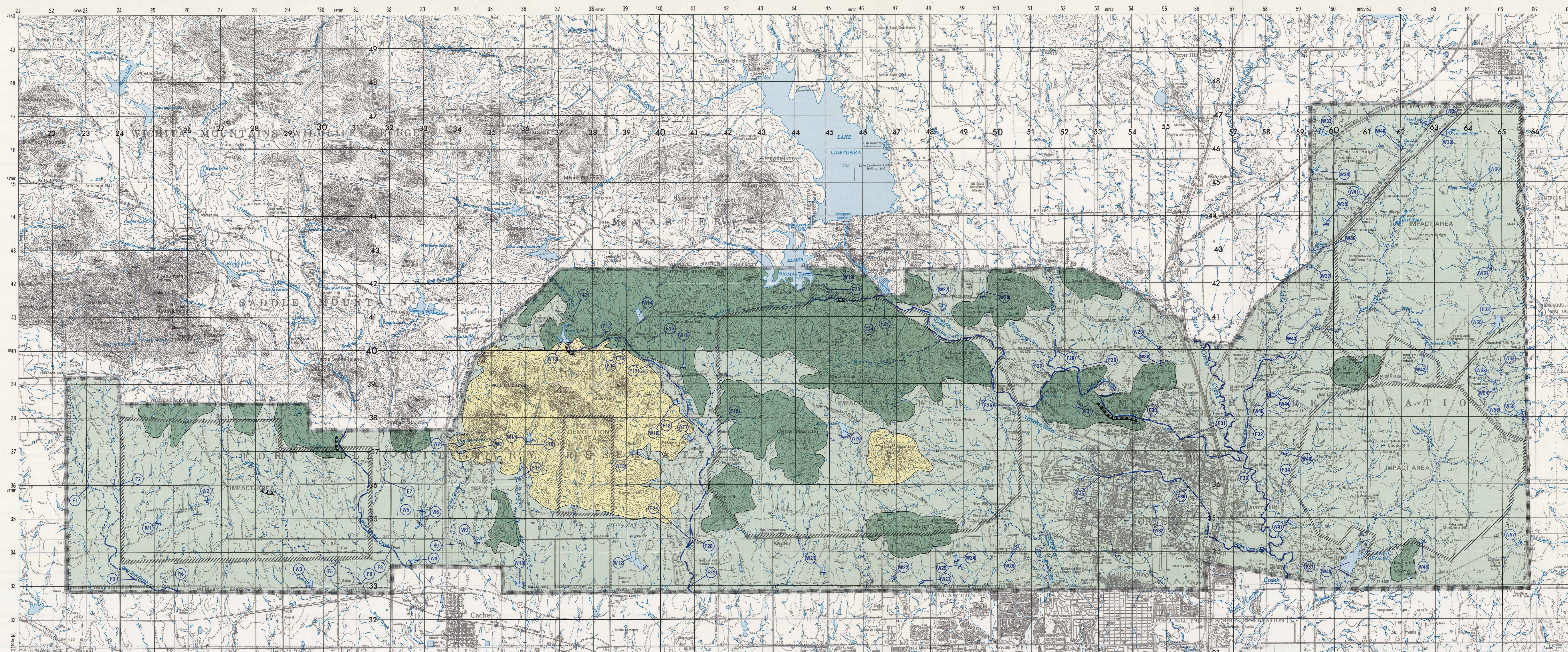
STREAM AND LOCATION	DRAINAGE AREA		DISCHARGE AT 10-YR FLOOD		DISCHARGE AT 25-YR FLOOD		DISCHARGE AT 50-YR FLOOD		DISCHARGE AT 100-YR FLOOD	
	km ²	(mi ²)	m ³ /sec	(ft ³ /sec)	m ³ /sec	(ft ³ /sec)	m ³ /sec	(ft ³ /sec)	m ³ /sec	(ft ³ /sec)
West Cache Creek Below confluence with Crater Creek	163.4	(63.1)	250	(8850)	379	(13,400)	481	(17,000)	623	(22,000)
West Branch Blue Beaver Creek at US Hwy 62	12.09	(4.67)	47.5	(1680)	70.8	(2500)	90.3	(3190)	115	(4050)
Blue Beaver Creek at old US Hwy 62	63.71	(24.6)	130	(4590)	166	(5860)	218	(7720)	279	(9850)



Aerial view south-southeast toward Medicine Bluffs, an escarpment in the high plains, and the cantonment area, in the low plains beyond.

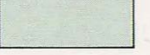





Medicine Creek, a perennial stream, looking north from the middle of ford 25 (grid reference 466415), picture taken in May at high water.










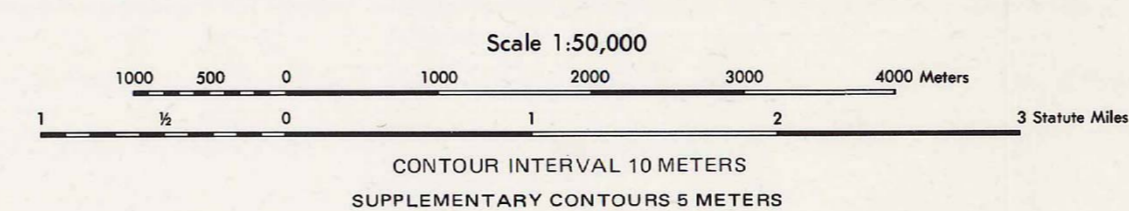
FORT SILL, OKLAHOMA TERRAIN ANALYSIS

SURFACE CONFIGURATION

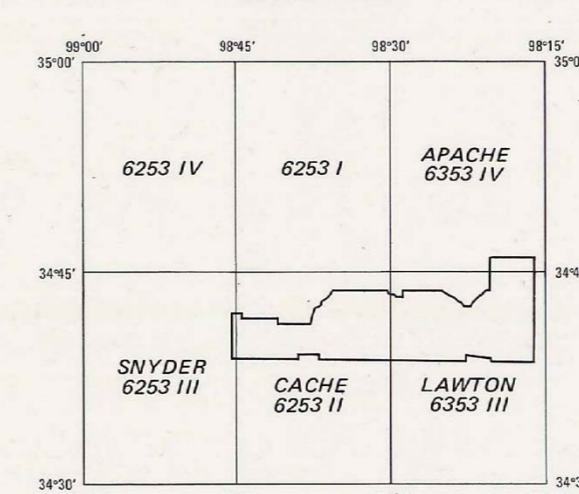
-  1. LOW PLAINS Nearly level to gently rolling plains; local relief largely between 20 and 30 m; slopes predominantly between 0 and 8 percent.
 -  2. HIGH PLAINS Gently to moderately rolling and locally deeply dissected uplands; local relief largely between 60 and 100 m; slopes range between 8 and 30 percent. Slopes along narrow valleys may exceed 45 percent.
 -  3. LOW HILLS Moderately to strongly rolling and deeply dissected, rugged uplands; local relief largely between 180 and 220 m; slopes generally range from 30 to 45 percent, commonly exceeding 60 percent in narrow valleys.
 -  Escarpment (slope > 100 percent)
- NOTE: Barbs and hachures point downlope.

SURFACE DRAINAGE

-  Watercourse width
3-10 m
 -  < 3 m
 -  Masonry dam
 -  Earth dam
 -  Lake, reservoir
 -  Ford
 -  Levee
- NOTE: Number refers to entry in table.



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FORT SILL, OKLAHOMA TERRAIN ANALYSIS

SURFACE CONFIGURATION SURFACE DRAINAGE

Prepared by Dames & Moore, Washington, DC, under the direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1980.

C. WATER RESOURCES

1. SURFACE WATER

Surface water is scarce in the Fort Sill area. Many of the streams are ephemeral, flowing only for brief periods during and immediately following local rainfall. Post Oak, West Cache, and Blue Beaver Creeks flow during seasonal periods of precipitation and following local rainfall. East Cache and Medicine Creeks are perennial streams; however, upstream regulation at Lake Ellsworth, Lake Lawtonka, and Elmer Thomas Lake has an impact on the available water. Peak precipitation and resulting streamflow generally occur during May, June, and October; locally intense storms may produce significant runoff from March through October. Volume of flow varies widely between high and low water periods.

Currently, the City of Lawton municipal system from Lake Lawtonka, on Medicine Creek, supplies water to Fort Sill. Lake Lawtonka is connected by pipeline to Lake Ellsworth, approximately 13 kilometers (8 miles) north of the reservation on East Cache Creek. Lake Ellsworth will be connected to Lake Waurika, approximately 16 kilometers (10 miles) south of the reservation, by a pipeline system being completed in 1980. The scarcity of water in the region created the need for a complex system of lakes and pipelines. There are no downstream water rights requiring discharges from either Lake Lawtonka or Ellsworth; therefore, during a drought, it is possible to close both lakes and allow no discharge. Gage records for East Cache Creek at Walters, Oklahoma, 30 kilometers (18.6 miles) downstream of Fort Sill, indicate that extreme droughts are probable; there was no flow at times in 1939 and 1940 and low flow is currently sustained by sewage effluent from the cities of Lawton and Walters.

During low water periods, seasonal streams on Fort Sill are reduced to scattered pools connected by trickles of water, which dry up during extended periods of drought. These streams flow with extremely large quantities of water during wet periods and following local storms. High flows peak quickly, however, and rapidly recede to pre-peak levels generally within 48 to 96 hours. Similarly, the numerous, small ephemeral tributary streams on the reservation rise and recede rapidly following rainfall. Although these

streams are normally dry, they also are capable of carrying very large flows for brief periods. Analyses of 7-day, 10-year low flows for streams in the Fort Sill area indicate that, under these conditions, no stream-flow could be expected on the reservation.

Reservoirs are numerous and widespread throughout Fort Sill, however, their small size and contributing drainage area preclude using many of them for water supply. Those few lakes, such as Lake George or Ketch Lake, which could supply water would be able to provide moderate supplies for only a brief time. See Section B, Surface Drainage, for further data on lakes and reservoirs.

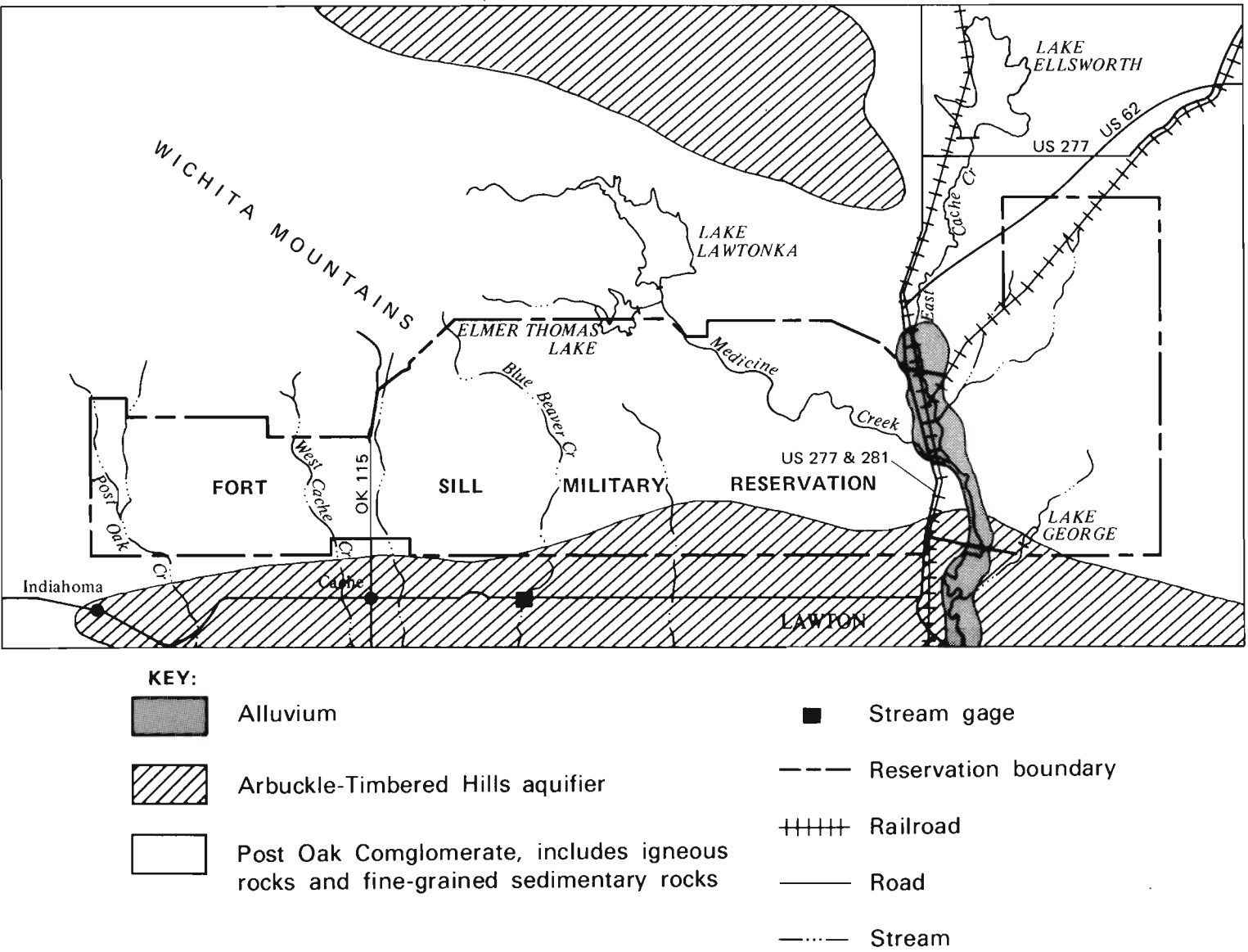
Surface water quality is generally good in the vicinity of Fort Sill although little data exists. Studies by the U.S. Army Environmental Hygiene Agency and other local agencies indicate that lakes and streams on the reservation are equal or better in quality than those in adjacent agricultural lands. The accompanying table presents representative analyses of surface water in the Fort Sill area and indicates the water ranges from soft to moderately hard. Data for Lakes Ellsworth and Lawtonka were obtained from the City of Lawton Public Works Department and are examples of the quality of water entering Fort Sill as well as the reservation water supply. Data for Blue Beaver Creek were obtained from the U.S. Geological Survey and are included because the creek is a benchmark stream, that is, a relatively undeveloped watershed against which other local streams can be compared to assess man's impact on water quality. Location of the gage downstream of the reservation (see accompanying figure) supports the determination that range activities have limited effects on surface water quality.

Sitting Bear Creek drains the cantonment area, largely consists of urban runoff and wash rack effluent, and would be unsuitable as a water supply. Likewise, East Cache Creek below the Fort Sill sewage treatment plant consists largely of sewage effluent and would be unsuited to water supply development.

	LAKE ELLSWORTH	LAKE LAWTONKA	BLUE BEAVER CREEK NEAR CACHE
SOURCE DATA			
Sampling Date	30 Oct 78	30 Oct 78	15 Feb 78
Discharge m ³ /sec (ft ³ /sec)			1.53 (54)
Specific Conductance μmhos/cm at 25°C			100
pH units	8.1	8.3	7.5
Water Temperature °C (°F)			3.0 (37.4)
CONSTITUENTS (mg/L)*			
Calcium	55	40	8.3
Magnesium	13	9.8	2.7
Sodium	26	15.7	6.3
Potassium	8.2	5	1.1
Bicarbonate			30
Sulfate	68	32	13
Chloride	31.5	16	4.8
Fluoride	0.25	0.25	0.3
Nitrate	0.44	0.68	
Hardness (as CaCO ₃)	192	141	32
Alkalinity (as CaCO ₃)	125	121	25
Iron	0.87	0.24	
Manganese	0.013	0.036	
Cadmium	0.0002	0.003	
Chromium	0.004	0.002	
Copper	0.007	0.0012	
Lead	0.020	0.001	
Selenium	0.030	0.015	
Zinc	0.007	0.013	
Mercury	<0.0001	<0.0001	
Barium	0.053	0.054	
Arsenic	0.023	0.026	

*For purposes of this study mg/L may be taken to be roughly equivalent to parts per million (ppm).

WATER RESOURCES, FORT SILL AND VICINITY



2. GROUND WATER

Fresh ground water is scarce on Fort Sill; the underlying geologic formations are not suited to ground water movement and the climatic conditions result in insufficient aquifer recharge. Ground water in the area is obtained from three aquifers: the Arbuckle-Timbered Hills Formations of Cambro-Ordovician age, the Post Oak Conglomerate of Permian age, and Quaternary alluvium. Ground water movement at Fort Sill is generally south and southeast away from the mountains and, locally, through alluvium toward streams.

The Arbuckle-Timbered Hills aquifer is composed largely of limestone and dolomite with interbedded shale. Permeability is due to solutioning along fault and joint planes which has created openings and zones where ground water can be transmitted and stored. As shown in the figure above, this aquifer underlies only a small portion of Fort Sill near the southern boundary; wells in this portion of the aquifer would be expected to provide only small to moderate yields. The reliability of wells in this aquifer depends on the number of fractures, joints, and zones intersected; some deep wells penetrating this aquifer have produced no water. Wells are typically deeper than 75 meters (250 feet) and many are between 300 and 600 meters (1000 and 2000 feet) in depth. Recharge is believed to occur south of the Wichita Mountains through the Post Oak Conglomerate. No springs or instances of streamflow augmentation are known from the Arbuckle-Timbered Hills aquifer on Fort Sill. Few data are available for ground water quality near Fort Sill, however, tests indicate that water from the Arbuckle-Timbered Hills aquifer is soft, because of low calcium and magnesium concentrations. General ranges of concentration for some other constituents are as follows: sodium, 24 to 96 milligrams per liter; chloride, 250 to 500 milligrams per liter; dissolved solids, 279 to 6380 milligrams per liter (average 1000 milligrams per liter); and fluoride, 1.6 to 17 milligrams per liter. The fluoride concentration exceeds the Oklahoma State Department of Health standards for public

water supply while the high sodium concentration renders the water unsuitable for irrigation. Near Fort Sill, water from this aquifer is generally used for industrial and recreation purposes.

Few data are available for the Post Oak Conglomerate, which consists of cobbles, gravel, sand, silt, clay, shale, and limestone conglomerate. The formation is believed to be the primary source of recharge for the Arbuckle-Timbered Hills aquifer and yields only minor amounts of water to wells. High fluoride and chloride concentrations cause water from this formation to be unpotable. The Post Oak Conglomerate has been combined with the igneous rocks of the Wichita Mountains and the fine-grained sandstones and shales of the plains in the above figure. Only minimal amounts of water are available from these other formations.

Quaternary alluvium consists largely of sand, clay, and gravel and is found along many streams. On Fort Sill, this alluvium is significant as a water supply only along East Cache Creek, as shown in the figure above. Yields from alluvium locally may be high but, because recharge is from streamflow and precipitation on the flood plain, quantities of available water are limited. Well tests, performed by the U.S. Army Engineer District at Fort Worth, Texas, as part of foundations investigations, indicate that it is possible to pump a well dry in the alluvium. The water is moderately hard to hard and dissolved solids range from 300 to 1750 milligrams per liter and average 600 milligrams per liter. Chloride ranges from 26 to 630 milligrams per liter but usually is less than 100 milligrams per liter in shallow wells; fluoride generally is less than 0.5 milligrams per liter. Water from alluvial deposits generally is used for irrigation and rural water supply. The only use of ground water on Fort Sill is at the Camp Eagle caretaker's house where a 3.7-meter (12-foot) well in alluvium provides a domestic supply.

D. ENGINEERING SOILS

A generalized pattern of soils on Fort Sill is outlined on the table and accompanying map, which define the prevalent physical, hydrologic, and engineering characteristics of the soils, particularly as these relate to general planning. This information provides a means for comparison of the key physical characteristics of various soils units on the reservation and gives a preliminary indication of their suitability and/or limitations with regard to development. It is intended to guide, not supplant, detailed site investigations in specific areas.

The map is based on information contained in soil surveys prepared by the U.S. Department of Agriculture, Soil Conservation Service and aerial photography dated February–March 1979.

Soils have been grouped into six map units. Each unit consists of soils that share certain characteristics, such as grain size distribution and depth or total thickness to bedrock. In most cases, soils are also combined on the basis of key landform associations (stream terrace, flood plain, upland) and/or on subsoil permeability characteristics (extremely rapid or slow percolation rates). Soil profiles summarized in the table are highly generalized and represent “average” typical profiles that can be expected for each major unit; actual conditions may vary to some extent, especially the thickness of the individual layers. Each of the six units is evaluated in terms of its limitations (slight, moderate, severe) for six common engineering applications. Major constraints, such as shallow rock, low bearing strength, or high shrink-swell potential, which would limit its use for development, are also identified.

The soils on Fort Sill consist of relatively young materials developed on unconsolidated stream deposits, and soils formed on limestone, shale, sandstone, conglomerate, granite, and rhyolite. Unit 1 occurs principally in the moderately to steeply sloping, hilly uplands of the Wichita Mountains. This soil is developed on granite, rhyolite, and colluvium and consists of sand, gravel, and cobbles, with numerous rock outcrops. Shallow rock and steep slopes severely limit the use of this soils unit.

Alluvial soils, Unit 2, consisting of silt and clay, are widely distributed throughout the reservation on nearly level to gently rolling flood plains, principally along West Cache, Blue Beaver, Medicine, and East Cache Creeks. Brief periods of flooding, primarily during May, June, and October, severely limit the use of this soils unit.

Unit 3 is found on nearly level to gently rolling upland plains and valleys and is predominant in the central portion of Fort Sill. These soils developed on conglomerate and sandstone and consist of clay and silt. High shrink-swell potential, low bearing strength, easy erodibility, and poor workability severely limit the use of this soils unit for most engineering uses. A small area of highly plastic clay is centered at grid reference 473329 and is significant because of its very high shrink-swell potential.

Unit 4 consists of silt and clay over sandy clay and gravel beds which occur on nearly level to gently rolling upland plains. This soil developed on conglomerate and, in places, on colluvium from the Wichita Mountains. Although this unit has low bearing strength and poor workability, it has the best overall soil characteristics for engineering uses, being severely limited only for road locations.

Units 5 and 6 consist of sand, silt, and clay on nearly level to gently rolling plains. Unit 5 occurs primarily in the western portion of Fort Sill along streams and is developed on conglomerate and sandstone. Unit 6 is the dominant soil in the eastern portion of the reservation where it developed on sandstone and shale. Both units have limited engineering uses because of seepage, which severely limits them for sewage lagoons and sanitary landfills, and the somewhat limiting characteristics of low bearing strength and easy erodibility. Additionally, Unit 6 may be limited by shallow rock or the presence of a claypan with high shrink-swell potential.

TYPICAL SOIL PROFILE*— LAYERS, THICKNESS OF LAYERS, DEPTH TO ROCK, UNIFIED ENGINEERING CLASSIFICATION (PROFILES NOT TO SCALE)				RATING† AND MAJOR LIMITING SOIL CHARACTERISTICS‡ FOR:										
MAP UNIT	LANDFORM AND SLOPE			HIGH WATER TABLE DEPTH	PERMEABILITY	SHRINK-SWELL POTENTIAL	SEWAGE LAGOONS	SANITARY LANDFILL	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFICABILITY	MAJOR SOIL SERIES AND REMARKS§	
1	Gently rolling to steeply sloping uplands, including some hill crests and colluvial slopes. Slopes highly variable; 3 to 15 percent in upland plains, 15 to 45 percent in hills. Frequent rock outcrops.	cm	SP GP	None	1.5 to 5 cm/hr (0.6 to 2 in/hr)	Low	Severe r, s	Severe r, s	Severe r, s	Severe r, s	Severe r, s	Severe r, s	No major soil series; generally shallow layer of coarse, weathered material over bedrock with numerous rock outcrops.	
		15	ROCK											Depth to granite, rhyolite, or limestone <0.15 to 1.2 m (<0.5 to 4 ft)
2	Nearly level to gently rolling alluvial plains, narrow stream valleys, and broken side slopes along streams. Slopes variable; generally less than 3 percent, may exceed 8 percent on side slopes.	cm	ML CL	None	1.5 to 5 cm/hr (0.6 to 2 in/hr); less than 0.15 cm/hr (0.06 in/hr) in claypan	Moderate; high in claypan	Severe f, p	Severe c, f	Severe f, l, x	Severe f, l, x	Severe c, f	Dry-Slight Wet-Severe f, l, w	Port Series and alluvial land in flood plains and broken side slopes along streams. Low-lying areas subject to brief periods of flooding March through October, most likely in May, June, and October.	
		200+	ROCK											Depth to bedrock 2 to 15 m (6 to 50 ft)
3	Nearly level to gently rolling upland plains and valleys. Slopes generally range between 0 and 8 percent.	cm	CL	None	Less than 0.5 cm/hr (0.2 in/hr); less than 0.15 cm/hr (0.06 in/hr) in claypan	High	Moderate s	Severe c	Severe l, x	Severe l, x	Severe c	Dry-Slight Wet-Moderate e, l, w	Foard, Vernon, Hollister, and Tillman Series. Occurs largely in central portion of reservation.	
		18	CL CH											Silty clay and clay of low to high plasticity; claypan common at depths greater than 30 cm (12 in)
		200+	ROCK											Depth to conglomerate or sandstone 2 to 5 m (6 to 16 ft)
4	Nearly level to gently rolling upland plains. Slopes generally between 0 and 8 percent.	cm	ML CL	None	0.5 to 5 cm/hr (0.2 to 2 in/hr)	Moderate	Moderate s	Moderate c	Moderate l, x	Severe l	Moderate c	Slight	Lawton Series. Residual soil developed on Post Oak Conglomerate; colluvial material from Wichita Mountains.	
		28	CL											Reddish brown clay of low to medium plasticity
		120	CL GC											Yellowish red sandy clay with occasional gravel beds
		200+	ROCK											Depth to sandstone or conglomerate 2 to 5 m (6 to 16 ft)
5	Nearly level to gently rolling plains near streams. Slopes generally range from 0 to 5 percent.	cm	SM	None	1.5 to 5 cm/hr (0.6 to 2 in/hr); 0.5 to 1.5 cm/hr (0.2 to 0.6 in/hr) in clay subsoil	Low; moderate in clay subsoil	Severe p, s	Severe c, p	Slight to moderate x	Severe l	Slight to moderate c	Slight	Konawa and Windthorst Series. Occurs primarily in western portion of Fort Sill.	
		20	SM CL											Silty fine sand and sandy clay
		45	SC CL											Sandy clay and silty fine sand
		200+	ROCK											Depth to sandstone or conglomerate 2 to 5 m (6 to 16 ft)
6	Nearly level to gently rolling upland plains. Slopes generally between 0 and 8 percent.	cm	SM SC	None	0.5 to 5 cm/hr (0.2 to 2 in/hr); less than 0.15 cm/hr (0.06 in/hr) in clay subsoil	Moderate; high in clay subsoil	Severe p, r, s	Severe c, p, r	Moderate l, r, s, x	Moderate l, r, x	Moderate c, r	Dry-Slight Wet-Moderate e, l	Zaneis Series and Lucien-Zaneis-Vernon Complex. Severely eroded in places. Occurs largely in the eastern portion of the reservation.	
		15	SC CL											Clayey sand and sandy clay of low to medium plasticity; locally, clay subsoil of medium to high plasticity
		25+	ROCK											Depth to sandstone or shale 0.25 to 2 m (0.75 to 6 ft)

*These are typical average layers based on the major soil series; thicknesses and composition may vary considerably from those shown.

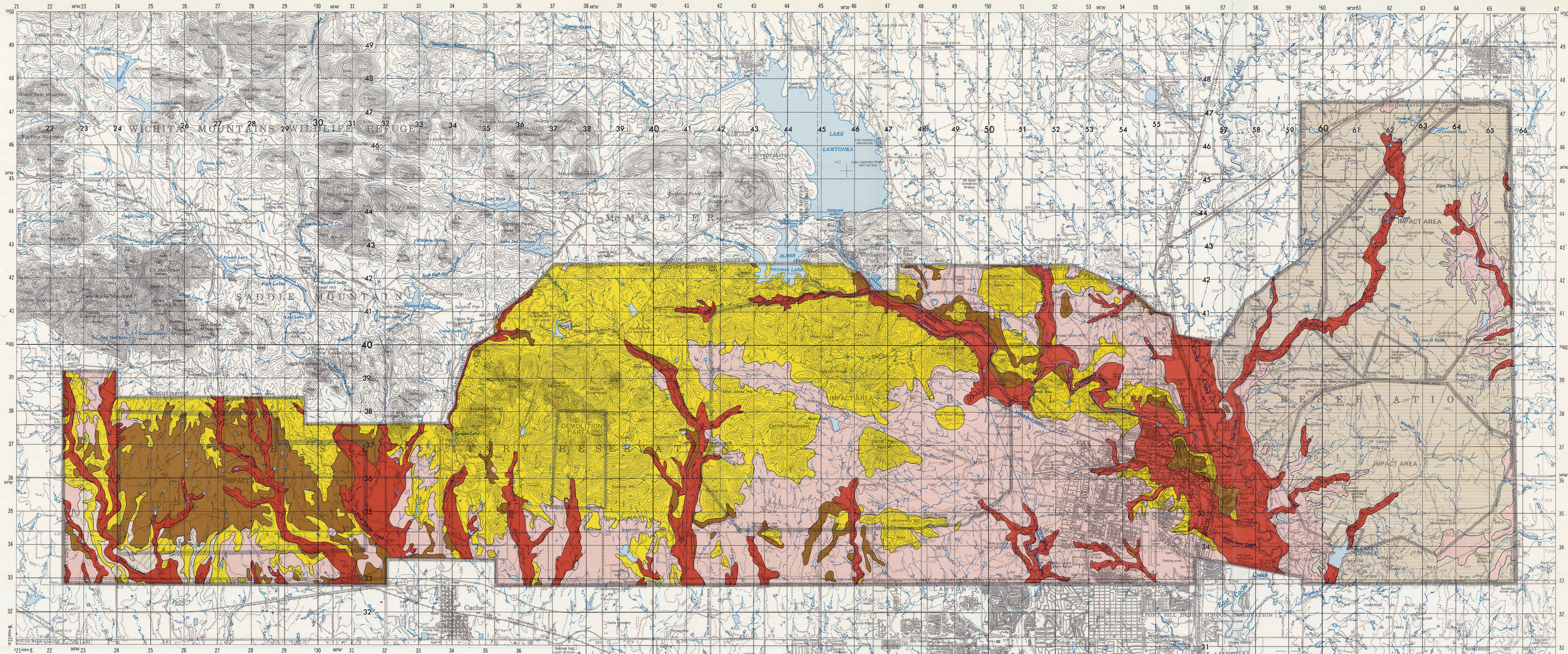
†Definitions of rating terms:

Slight = relatively free of limitations or limitations are easily overcome.
Moderate = limitations can be overcome with good planning and/or careful design.
Severe = limitations are serious and are difficult to overcome.

‡Soil characteristics affecting ratings:

c = clayey subsoils-poor workability
e = easily eroded
f = flooding
l = low bearing strength
p = seepage
r = shallow or exposed rock
s = steep slope
u = unstable, cutbanks cave
w = slick when wet
x = high shrink-swell potential

§Soils that have profiles almost alike make up a soil series. Each series is given a common name after the town or geographic feature near its initial observation. Many other minor soils are included in the map unit.



FORT SILL, OKLAHOMA TERRAIN ANALYSIS

ENGINEERING SOILS

COARSE-GRAINED SOILS

1. Sand, gravel, and cobbles with numerous rock outcrops, **SHALLOW* to MODERATELY DEEP.**

FINE-GRAINED SOILS

2. Clayey silt and silty clay of low to medium plasticity, **DEEP to VERY DEEP.**
3. Silty clay over silty clay and clay of low to high plasticity, **DEEP.**

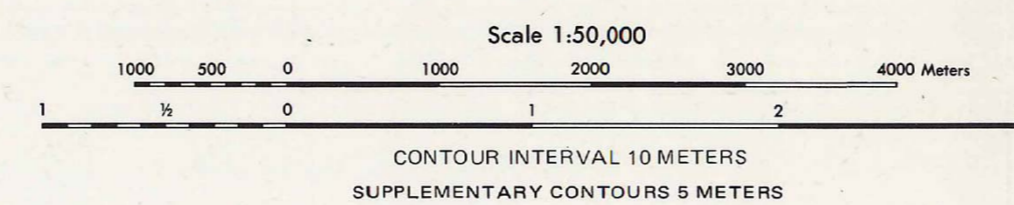
COARSE-GRAINED AND FINE-GRAINED SOILS

4. Silt and clay of low to medium plasticity over sandy clay with occasional gravel beds, **DEEP.**
5. Sand and silt over silty fine sand and sandy clay, **DEEP.**
6. Fine sand, silt, and clay of low to medium plasticity, **SHALLOW to MODERATELY DEEP.**

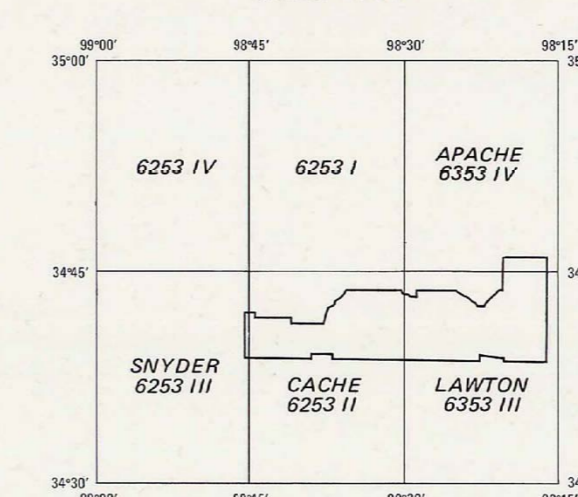
NOTE: Number refers to entry in table.

*Definition of terms in bold print:

Depth Terms	Meters	Feet
VERY DEEP	>6	>20
DEEP	2-6	7-20
MODERATELY DEEP	0.6-2	2-7
SHALLOW	<0.6	<2



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FORT SILL, OKLAHOMA TERRAIN ANALYSIS ENGINEERING SOILS

Prepared by Dames & Moore, Washington, D.C. under the direction
of the Terrain Analysis Center, U.S. Army Engineer Topographic
Laboratories, Fort Belvoir, Virginia. December 1980.

E. ENGINEERING GEOLOGY

The table below and the accompanying Engineering Geology map indicate the extent and distribution, geologic characteristics, and geotechnical properties of seven engineering geology units on Fort Sill. These units are evaluated as to their topographic and geotechnical suitability for construction sites and route alignments, foundation stability for supporting light and heavy structures, cut-slope stability for road and bridge construction, and potential as sources of construction materials. Key geographic and geotechnical characteristics, such as the type of overburden, relative drilling rates, relative resistance to erosion, suitability for excavation and compaction, permeability, and swelling potential are also evaluated to determine additional impacts or constraints to engineering development. The units are divided into three major suitability categories, those having numerous, those having some, and those having few engineering uses.

The two oldest rocks on Fort Sill are rhyolite and granite, Units 5 and 6 respectively, both igneous rocks of Cambrian age. These units occupy extensive areas of the Wichita Mountains in the central portion of the reservation. Both units offer excellent foundation stability for heavy structures, however, topography limits their engineering uses; Unit 6 has somewhat steeper slopes and rougher land surface than Unit 5, but neither is suitable for development.

Limestone, limestone conglomerate, and dolomite of Cambro-Ordovician age form several small hogbacks in the south-central portion of the reservation. These rocks, Unit 4, exhibit excellent foundation stability and are a good source for some construction material; this is the only unit on Fort Sill that has been quarried. However, limited exposures and moderate slopes restrict the usefulness of this unit for engineering purposes.

Rhyolite and granite porphyry conglomerates of Permian age directly overlie the parent formations (Units 5 and 6) near the Wichita Mountains, but thin and grade into finer sediments farther south. These conglomerates, Unit 1, are the most extensive on the reservation and occupy much of the upland plains west of East Cache Creek. Unit 1 provides excellent foundation stability for moderate structures and is well suited to road alignments and multistructure emplacements as exhibited by the development of much of the cantonment area in this unit.

Permian sandstone and mudstone conglomerate, Unit 3, overlies older Cambrian formations. These sediments occupy narrow bands along the East Cache Creek flood plain and are suitable for light construction and road alignments.

Unit 2, which overlies Unit 3, consists of extensive areas of shale with some sandstone of Permian age. These sediments occupy much of the reservation east of the East Cache Creek flood plain. Though difficult to excavate, the unit provides good foundation stability and extensive areas for development and straight road alignments.

The youngest sediments on Fort Sill are unconsolidated alluvial deposits consisting of sand, clay, and gravel. These sediments occur along East Cache Creek and in the flood plains of other smaller streams including West Cache and Blue Beaver Creeks. These deposits, Unit 7, exhibit poor foundation stability and are subject to occasional flooding.

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
1. Granite and rhyolite porphyry conglomerate overlain by sand and gravel.	<p>Underlies the major portion of the reservation to the west of East Cache Creek, including the cantonment area. The most extensive exposures are in the extreme western part of Fort Sill and in the upland plains in the south-central portion of the reservation. The unit is characterized by nearly level to gently rolling surfaces mantled by residual soils ranging in thickness from 2 to 5 m (6 to 16 ft). Rock outcrops occur principally in stream cuts in the central and western portions of the reservation.</p> <p>Mean local relief is generally less than 30 m (98 ft); maximum local relief, approximately 50 m (164 ft), occurs near the north reservation boundary in the West Cache Creek drainage basin. The highest elevation in the unit, approximately 493 m (1617 ft), is near the north reservation boundary east of Costain Hill (grid reference 392424); the lowest elevation, approximately 345 m (1132 ft), occurs near Henry Post Army Airfield (grid reference 553329). Slopes vary, ranging from less than 3 percent near the south reservation boundary to 15 percent adjacent to the Wichita Mountains. Drainage is moderate to fine textured and the pattern is typically linear dendritic.</p>	<p>Comprises the Permian Post Oak Conglomerate and the overlying colluvial and mountain-wash deposits of Pleistocene age.</p> <p>The Post Oak Conglomerate on Fort Sill is characterized by two distinct lithofacies, consisting of granite boulder conglomerate in the west, grading into rhyolite porphyry conglomerate in the east, in the approximate area of Blue Beaver Creek. Both facies are coarsest in texture near the mountains and grade into finer textures in the upland plains south of the mountains. The granite boulder conglomerate contains cobbles and boulders ranging from 15 to 45 cm (6 to 18 in) in diameter and cemented by calcite, limonite, and clay. Near the mountains, the cobbles are interbedded with crossbedded arkose lenses; arkose lenses increase in number away from the mountains. Granite boulder conglomerate weathers to beds of well-rounded boulders and yellow to brownish yellow clay. The rhyolite porphyry locally contains interbeds of limestone conglomerate near limestone outcrops; however, it is largely composed of light pink to yellowish brown pebbles and boulders which are angular to subangular, with few rounded cobbles. The Post Oak Conglomerate unconformably overlies the older granite and rhyolite rocks on Fort Sill. Residual soil is less than 5 m (16 ft) thick; total unit thickness ranges from 120 to 150 m (400 to 500 ft).</p> <p>The Pleistocene deposits, chiefly sand and gravel, are composed of rounded to partially rounded particles of granite and rhyolite. Cobbles, ranging in diameter from 15 to 25 cm (6 to 10 in), dominate these deposits although much finer materials are also present. The gravels are primarily yellow in color and exhibit a high degree of particle smoothness. Deposits occur principally at the base of steeper slopes; they gradually thin out away from the mountains, exposing the underlying Post Oak Conglomerate. Residual soil cover is less than 1 m (3 ft). Thickness of these deposits on Fort Sill is generally less than 5 m (16 ft).</p>	<p>Permeability: Low Swelling potential: Low Plasticity: Nonplastic Shear strength, Mg/m² (tons/ft²): 53.7 (5.5)</p>	<p>Large expanses of nearly level to moderately rolling upland terrain are generally suited for most types of engineering construction, such as straight to slightly curving alignments for roads and multistructure emplacements; accessibility by the existing road network is excellent.</p> <p>Slight to moderate grading and cut-and-fill operations are required for road construction. Culverts are sufficient to carry flows in most locations; bridging is required only at West Cache Creek. Exposed slopes are potentially susceptible to piping erosion; soil stabilization and grass seeding during construction can reduce erosion problems.</p> <p>Foundation stability is excellent for lightly to moderately loaded structures when excavated to sound material; borings are recommended prior to site selection for heavy structures. Moderate cut slopes are required and shoring may be necessary in excavations.</p> <p>Weathered granite cobbles from the unit have locally been used as building stone, however, the unit is generally a poor source of construction materials. The conglomeratic nature of the unit renders it unsuitable for quarrying as building stone, road material, or riprap, but it is a fair source of fill. Excess fines are also present and detract from the unit's suitability as a source of sand and gravel.</p> <p>The highly variable nature of the unit and its overlying mantle of residual soil indicate that limited areas may be suited to the disposal of solid or liquid wastes. Borings are recommended prior to site selection to determine local permeability and related characteristics.</p>	<p>Excavation with power equipment is generally easy, except where cobbles and boulders are abundant. Equipment has easy access to all of the unit through existing roads.</p> <p>Overburden is highly variable, consisting of sand, silt, clay, some gravel, and cobbles, and is easily excavated. Drilling is also easy. Compaction of the material is moderately easy; smooth-tired rollers and vibratory compactors are recommended.</p> <p>Cut-slope stability is fair for moderate slopes; shoring may be required to prevent slumping.</p>	<p>No sites are currently in use and none are recommended; the unit is unsuited as a source of sand and gravel and does not supply other construction material.</p>
2. Shale with some sandstone.	<p>Underlies the major portion of the area east of East Cache Creek. Most of the unit forms nearly level to moderately rolling upland plains characterized by gently sloping ridge crests which form local northeast-southwest trending drainage divides. Residual soil thickness ranges between 0.6 and 2 m (2 and 6 ft). Rock is exposed locally in stream valleys and in severely eroded areas where soil cover is thin.</p> <p>Mean local relief is generally less than 20 m (66 ft); maximum local relief, approximately 50 m (164 ft), occurs near Arbuckle Hill (grid reference 620334). The highest elevation, approximately 404 m (1325 ft), is on Arbuckle Hill; the lowest elevation, approximately 345 m (1132 ft), occurs in a minor stream valley east of Quarry Hill (grid reference 591356). Slopes rarely exceed 15 percent and most are less than 3 percent. Drainage is moderate to fine textured and the pattern is strongly linear dendritic.</p>	<p>The Permian Hennessey group consists predominantly of red to gray shale with some tan to reddish brown fine-grained sandstone. Strata are generally thin-bedded and fractures are common in exposed sections. The unit overlies the Garber Sandstone and weathers to clay and fine-grained sand. Residual soil is between 0.6 and 2 m (2 and 6 ft) thick; unit thickness ranges from 40 to 60 m (130 to 200 ft).</p>	<p>Permeability: Low Swelling potential: Low Plasticity: Nonplastic</p>	<p>Large expanses of nearly level to moderately rolling upland terrain in the eastern portion of the reservation are generally suited for most types of light construction. Sites for multistructure emplacements or long straight road alignments are readily available. Existing roads provide excellent access throughout the unit.</p> <p>Road construction requires only slight to moderate amounts of grading or cut-and-fill and bridging is not required. The residual soil cover is easily eroded and should be protected during construction operations by wetting and/or seeding.</p> <p>Foundation stability for heavy structures is good and requires excavation to sound material. Cut slopes are stable to fairly high angles if there is no undercutting.</p> <p>The unit is a source of poor quality fill and, because of excess fines in the overburden, is a poor source of sand and gravel.</p> <p>The unit is unsuitable for disposal of both liquid and solid waste because it is difficult to excavate and has low permeability.</p>	<p>The unit is not easily excavated with hand tools or small power equipment. Excavation with heavy power equipment is moderate to difficult depending upon local fracturing. Equipment has easy access through existing roads.</p> <p>Overburden material consists of residual fine sands and silts and is readily excavated by hand. Drilling rates are moderate. Compaction is easy to moderate.</p> <p>Cut slopes remain stable at fairly steep angles if there is no severe undercutting.</p>	<p>Currently there are no sites within the unit and none are recommended.</p>
3. Sandstone and mudstone conglomerate.	<p>This unit crops out in narrow bands in the eastern portion of Fort Sill adjacent to the alluvial plain of East Cache Creek. It forms nearly level to moderately rolling upland areas and is dissected by numerous west-southwesterly flowing tributaries of East Cache Creek. Residual soil is thin, generally ranging from 0.6 to 5 m (2 to 16 ft). Rock is exposed mainly in stream cuts and in scattered ledges along the upper slopes.</p> <p>Local relief varies; mean local relief is approximately 34 m (112 ft) in the vicinity of Adams Hill (grid reference 598339). The highest elevation in the unit, approximately 390 m (1280 ft), is in the upper portion of the Wrattan Creek basin (grid reference 627385); the lowest elevation, approximately 339 m (1112 ft), occurs near East Cache Creek west of Adams Hill (grid reference 591342). Slopes are predominantly less than 3 percent, however, they commonly exceed 8 percent near Adams Hill. The drainage texture is medium to fine and the streams exhibit a typically dendritic pattern.</p>	<p>Permian Garber Sandstone consists of reddish-brown, fine-grained sandstone and mudstone conglomerate and a basal sandstone member, the Asphaltum Sandstone bed. The unit is thin-bedded and is overlain by the younger Hennessey group (Unit 2).</p> <p>The Asphaltum Sandstone is a porous rock that is impregnated naturally with asphalt. A portion of this member is exposed in a tar pit on Adams Hill (grid reference 597338).</p> <p>This unit weathers to fine-textured soils and pebbles; residual soil thickness is less than 5 m (16 ft). The Asphaltum Sandstone member ranges in thickness from 3 to 18 m (10 to 60 ft); total unit thickness ranges from 49 to 64 m (160 to 210 ft).</p>	<p>Permeability: Low Swelling potential: Low Plasticity: Noncritical Dry density, kg/m³ (lb/ft³) (3 samples): 2131 (133), 2163 (135), 2451 (153) Unconfined compressive strength, Mg/m² (tons/ft²): 362 (37.1)</p>	<p>Generally suited for some engineering uses, including light construction and road alignments. The unit underlies extensive areas of gently to moderately rolling terrain suitable for development and is easily accessible through existing roads.</p> <p>Moderate grading and cut-and-fill would be required for road construction. Culverts can carry flows throughout the unit except at Medicine Creek, where bridging is recommended but large fords may be sufficient. Precautions should be taken during construction to prevent erosion caused by the loss of residual soil cover.</p> <p>Foundation stability ranges from fair to excellent; foundations should be excavated to sound material. Moderately cut slopes are required and undercutting causes rockfalls.</p> <p>The unit can be a fairly good source of construction material including road material and fill. Thicker beds within the unit can be sources for building stone or riprap.</p> <p>The unit is generally unsuited for liquid waste disposal, but may be used to dispose of solid waste because there is little risk of polluting ground water supplies. The landfill currently in use on Fort Sill is located in this unit.</p>	<p>Excavation with heavy power equipment is moderately easy, however, blasting may be required locally in hard sandstone. Excavation equipment has easy access through existing roads.</p> <p>Overburden consists of fine sand, clay, and some gravel and is easily removed by hand tools and small power equipment. Drilling rates are slow to moderate. Compaction is difficult and may require crushing and mixing with a binder material.</p> <p>Cuts require moderate slopes and undercutting may lead to rockfalls.</p>	<p>There are currently no pits or quarries within the unit. Potential sites, including the slopes along the east side of the East Cache Creek flood plain, could supply road material and fill. Access to these sites is good through existing roads.</p>

E. ENGINEERING GEOLOGY (Continued)

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
4. Limestone, limestone conglomerate, and dolomite.	<p>Exposed in small, isolated hogbacks in the south-central portion of the reservation. McKenzie Hill (grid reference 472346) is the most prominent hogback; other exposures include Quarry Hill (grid reference 573350) and Kerr Hill (grid reference 436343). The unit forms moderately rolling slopes. Residual soil cover is thin, less than 1 m (3 ft), and bedrock is exposed in many locales.</p> <p>Local relief varies widely, ranging from approximately 10 m (33 ft) in small outcrop areas to a maximum of approximately 70 m (230 ft) near McKenzie Hill. The highest elevation, approximately 450 m (1476 ft), is on McKenzie Hill; the lowest elevation, approximately 339 m (1112 ft), occurs on the quarry floor at Quarry Hill. Slopes are predominantly between 8 and 15 percent; some slopes on the north side of McKenzie Hill may approach 30 percent. Drainage is coarse textured throughout the unit. The drainage pattern is linear dendritic.</p>	<p>Comprises the Upper Cambrian Timbered Hills group and the overlying Arbuckle group of Cambro-Ordovician age.</p> <p>The Timbered Hills group consists of the Reagan Sandstone and the overlying Honey Creek Formation. The Reagan Sandstone is a dull green, glauconitic sandstone and sandy limestone and is exposed on Kerr Hill. The thickness of the Reagan Sandstone is approximately 60 m (200 ft), although only the upper 12 m (40 ft) are exposed at this location. The Honey Creek Formation is a thick-bedded, coarsely crystalline limestone, approximately 55 m (180 ft) thick.</p> <p>The Timbered Hills group is conformably overlain by the Arbuckle group, principally the Fort Sill Limestone, the Signal Mountain Limestone, the McKenzie Hill Limestone, and the Strange Dolomite. The Fort Sill Limestone is a light gray, predominantly thin-bedded to platy limestone. Maximum thickness on the reservation is 68 m (224 ft). Unconformably overlying the Fort Sill Limestone is the Signal Mountain Limestone, consisting of thin- and thick-bedded sequences of limestone and limestone conglomerate, approximately 90 m (300 ft) thick. The basal 9 m (30 ft) are largely calcareous sandy pebbles. The Signal Mountain Limestone is overlain by the McKenzie Hill Limestone, consisting of dense to coarsely crystalline limestone and conglomerate, of variable bed thickness. The lower part of the McKenzie Hill Limestone contains several conglomerate beds; thickness of this member on Fort Sill is approximately 70 m (230 ft). The uppermost member of the Arbuckle group on Fort Sill is the Strange Dolomite, which is locally exposed on the crest of McKenzie Hill. This member is composed mainly of crystalline dolomite and is approximately 24 m (80 ft) thick.</p>	<p>Permeability: Low Swelling potential: Low Plasticity: Nonplastic</p>	<p>Limited exposures in the southern portion of the reservation do not permit long, straight alignments; however, portions of gently rolling terrain are suitable for some engineering uses. Existing roads provide excellent access to exposures, though usually skirting the exposures because of shallow rock and higher slopes than in the surrounding plains.</p> <p>Roads may require moderate grades and cuts and fills may be necessary locally; cuts will require blasting. Bridging would not be required because flows can be carried by culverts. Stability of cut slopes is generally poor where the bedding planes dip into the cut face; retaining walls may be required to prevent rockslides due to undercutting.</p> <p>Foundation stability for heavy structures is excellent and the bearing capacity is usually high. Foundation excavations should reach sound material; the possibility of foundation disruption or displacement is very low.</p> <p>The unit is an excellent source of construction material including road material, base course, fill, aggregate, railroad material, and building stone. Limestone from Quarry Hill was used to construct many buildings of the Old Post, most of which are still in use over 100 years later.</p> <p>Disposal of solid and liquid wastes within this unit is difficult because of shallow rock and thin stony soil. Slow permeability makes the unit unsuited for liquid waste disposal, but the relatively low risk of polluting ground water supplies makes the disposal of solid wastes a possibility where proper design precautions are exercised.</p>	<p>Excavation of overburden is easy with hand tools, but bedrock will require blasting and quarrying. Access through existing roads is excellent.</p> <p>Overburden consists of residual loam, gravel, and cobbles and is generally very thin. Drilling rates are slow. Compaction is generally difficult and may require crushing and mixing with binder material.</p> <p>Moderate slopes may be required where bedding planes dip into cut faces, but generally cut faces may stand vertical.</p>	<p>Several pits and quarries have been used within the unit, however, none are currently in use. Any of these locations could be reopened or other portions of the unit could be utilized, depending largely on convenient access via existing roads. These sites have provided a variety of materials ranging from road material and aggregate to building stone such as that in buildings of the Old Post.</p>
5. Rhyolite and diabase.	<p>Extensively exposed in the Wichita Mountains in the central portion of the reservation and in the very steeply sloping Medicine Bluffs immediately north of the cantonment area. The unit forms moderately to strongly rolling terrain, which is locally characterized by rounded hilltops having a smooth-textured appearance. Residual soil cover is thin, generally less than 1 m (3 ft), and rock is exposed in many localities.</p> <p>Mean local relief is approximately 100 m (328 ft); maximum local relief, approximately 150 m (492 ft), occurs in the vicinity of Signal Mountain (grid reference 467368). The highest elevation, approximately 539 m (1768 ft), is on Carlton Mountain (grid reference 440374); the lowest elevation, approximately 342 m (1122 ft), occurs along Medicine Creek near Medicine Bluffs (grid reference 543379). Slopes are largely between 15 and 30 percent, however, slopes along Medicine Bluffs and in narrow stream valleys are very steep, often exceeding 100 percent. Drainage is fine to medium textured and the pattern is strongly linear dendritic.</p>	<p>Consists of the Carlton Rhyolite, a Cambrian igneous rock which is one of the two oldest rocks outcropping on the reservation.</p> <p>The rhyolite is aphanitic to very fine grained and varies in color from light pink to brick red or light to dark gray where freshly exposed, and from buff to brown on weathered surfaces. The unit is highly jointed and fractured, and weathers to small angular fragments, which result in rounded hills with a characteristic smooth appearance. Locally, the rhyolite has been altered to a white to light gray resistant formation, particularly in the exposures along Medicine Bluffs. Diabase dikes are also present within this unit. Soil cover is thin, generally less than 1 m (3 ft). Maximum thickness of the rhyolite series is approximately 1370 m (4500 ft).</p>	<p>Permeability: Low Swelling potential: Low Plasticity: Nonplastic</p>	<p>The absence of gently rolling terrain renders this unit unsuitable for most types of engineering construction with the exception of road alignments. Nearly straight alignments suitable for road and railroad construction are limited to valleys. Portions of Deer Creek Canyon Road and Blue Beaver Valley Road follow valley alignments where they traverse the unit; these roads also provide good access to the unit; other access is limited to unimproved roads, trails, and firebreaks.</p> <p>Road construction within this unit requires moderate to substantial amounts of grading, cut-and-fill, and bridging. Cut slopes have fair to good stability; due to fracturing, moderate slopes may be necessary.</p> <p>Foundation stability is excellent and bearing capacity is generally very high when excavated to sound material. The unit is excellent for tower locations, but would require rock anchors.</p> <p>The unit could be a good source of road material, riprap, and fill.</p> <p>The unit is poorly suited for the disposal of liquid or solid wastes because it is difficult to excavate, soil is thin and rocky, and slopes are largely prohibitive.</p>	<p>Excavation of this unit generally requires blasting though tractor-drawn rippers also may be used locally. Excavating equipment has access to some areas through existing roads, however, much of the unit would be accessible only by trails.</p> <p>Overburden is generally thin with occasional rock outcrops and consists largely of sand, gravel, and cobbles. Overburden material is generally compact and is readily excavated by hand or small power equipment. Drilling is difficult and may be locally hindered by diabase dikes. Compaction is moderately difficult and usually requires mixing with a binding material; hauling equipment and smooth-tired rollers are recommended.</p> <p>Stability in cut slopes is fair to good; moderate slopes may be necessary where rocks are highly fractured.</p>	<p>No pits or quarries exist in this unit. Potential sites include Mount Hinds and areas along Deer Creek Canyon where access would be easy through existing roads.</p>
6. Granites of various textures.	<p>Crops out extensively in the west-central portion of Fort Sill, along the north-central reservation boundary, and in smaller isolated exposures, such as Gruber Hill (grid reference 419355). The unit is characterized by moderately to strongly rolling, rugged hills with somewhat rounded crests and steep rocky slopes. Boulders are scattered about the surface in many areas, particularly at the base of steeper slopes. Soil cover is thin, less than 1 m (3 ft); rock outcrops are numerous and widespread.</p> <p>Local relief varies widely; mean local relief is approximately 190 m (623 ft). Maximum local relief, approximately 250 m (820 ft), occurs near Mount Sherman (grid reference 383384). The highest elevation on Fort Sill, approximately 673 m (2207 ft), is on Mount Sherman; the lowest elevation in this unit, approximately 360 m (1181 ft), is on low slopes east of Craig Hill (grid reference 536418). Slopes are predominantly between 30 and 45 percent, however, slopes in narrow stream valleys and on sidehills locally exceed 60 percent. Drainage is fine to medium textured and the pattern is markedly linear dendritic and rectangular, reflecting strong control of drainage by jointing and faulting.</p>	<p>Consists of the Cambrian Wichita Granite, one of the two oldest rocks exposed on Fort Sill. The series includes five types of igneous rocks: fine-grained, non-porphyrritic granite; medium-grained porphyritic granite; medium- to coarse-grained granite which is locally porphyritic; fine-grained granite dikes; and fine-grained diabase dikes.</p> <p>Color ranges from light pink to red on fresh surfaces and from light brown to dull red on weathered surfaces. Major joints are perpendicular, striking west-northwest and north-northeast, and the dip of the joint planes varies from 35 degrees to near vertical. Fractures and joints are more common in the finer-textured granites, a condition which causes these rocks to weather to smaller particles as compared to more widely spaced jointing in the coarser granites that results in weathering to large boulders. Many boulders also have been rounded by exfoliation. Soil is thin, generally less than 1 m (3 ft). The thickness of the granite series is estimated to vary considerably, between 180 and 4570 m (600 and 15,000 ft).</p>	<p>Permeability: Low Swelling potential: Low Plasticity: Nonplastic</p>	<p>Moderately to steeply sloping terrain in this unit renders it unsuitable for most engineering uses. There are no areas large enough for multistrucre emplacements, roads, railroads, or airfields. No roads traverse the unit; access is limited to short, unimproved dirt roads and trails.</p> <p>Road construction within this unit requires substantial grading, cut-and-fill, and bridging. Stability of cut slopes is generally good, but is poor where joint and fracture planes dip into the cut; debris and granite blocks may slide on joint planes, particularly if undercut.</p> <p>Foundation stability is excellent and bearing capacity is generally very high. The possibility of disruption or displacement of foundations by erosion, freeze-and-thaw, solution, piping, and earthquakes is very low. The unit is well suited for tower locations because of topography and foundation stability, but towers would require rock anchors.</p> <p>Granite is a good source of road material, riprap, building stone, embankment facing, and fill.</p> <p>The unit is not suitable for disposal of liquid or solid wastes because it is difficult to excavate, soil is thin, rock outcrops are common, and slopes are moderate to steep.</p>	<p>Excavation is difficult and is hampered by boulders at or near the surface; excavation with heavy tractor-drawn rippers may be possible, but more commonly, blasting is required. Access for excavating equipment is primarily through unimproved dirt roads.</p> <p>Overburden is fairly thin and consists largely of cobbles, gravel, and sand formed by weathering of the granite and colluvial, down-slope movement. Overburden can be excavated by hand or small power equipment. Drilling is difficult. Compaction is moderately difficult and mixing with binder material is generally required before compaction. Hauling equipment and smooth-tired rollers are recommended.</p> <p>Cut slopes stand vertical for a long time; rockfalls may occur where fracture planes dip into cut faces.</p>	<p>No pits or quarries exist in this unit, however, possible quarry sites occur anywhere there is an outcrop, scarp, or cut face. Accessibility is poor.</p>
7. Sand, clay, and gravel.	<p>Forms the nearly level flood plains of East and West Cache Creeks and scattered tributary valleys. Although most of the stream channels are locally incised and bounded by steeply sloping to vertical banks, slopes within the unit rarely exceed 3 percent.</p> <p>Mean local relief is generally less than 3 m (10 ft); maximum local relief, approximately 10 m (33 ft), occurs in the valley of East Cache Creek east of the cantonment area. The highest elevation in the unit, approximately 395 m (1296 ft), occurs along West Cache Creek (grid reference 311349); the lowest elevation on Fort Sill, approximately 329 m (1079 ft), is along East Cache Creek near the south reservation boundary (grid reference 586332). Streams are characterized by linear dendritic to tightly meandering and rectilinear channels. The unit is subject to occasional flooding.</p>	<p>Recent and Pleistocene alluvial deposits.</p> <p>Alluvium in the flood plain of East Cache Creek consists largely of clay, silt, and fine sand. Alluvium in the flood plains of other major streams is generally coarser in texture and consists predominantly of sand, gravel, silt, and clay. Gravel is composed largely of pebbles and cobbles of granite and rhyolite washed from the surrounding mountains. The unit ranges in color from tan to dark brown and is covered by soils generally less than 3 m (10 ft) thick. Total thickness of the unit ranges from 0 to 15 m (0 to 50 ft).</p>	<p>Permeability: Moderate Swelling potential: Low to moderate Plasticity index (3 samples): 13, 18, 26 Liquid limit (3 samples): 28, 38, 42 Dry density, kg/m³ (lb/ft³) (3 samples): 1650 (103), 1682 (105), 1730 (108)</p>	<p>Generally poorly suited to most engineering uses. Although the nearly level flood plains provide straight to curvilinear alignments generally suited for roads and railroads, flooding would severely limit placement of structures and transportation routes in this unit without the construction of embankments above base flood elevations. Bridging is required over major stream crossings.</p> <p>Foundation stability of the upper 6 m (20 ft) is generally poor, but improves with depth due to the presence of stiff clay and silt layers and local bedrock conditions. Foundations for structures in the upper portions of the unit will require spread footings on slabs to prevent settling.</p> <p>The unit is generally fair as a source for road fill; excessive fines would preclude use as a source for sand and gravel.</p> <p>Occasional flooding would preclude its use for sanitary waste disposal facilities.</p>	<p>Alluvial deposits are easily excavated with power and hand tools. Access is good, except in areas not traversed by existing roads.</p> <p>Excavations are subject to flooding or seepage. Walls of excavations would require shoring to prevent slumping. Adequate drainage maintenance is recommended during all construction.</p>	<p>A fair source for road fill, potential sites are scattered throughout East and West Cache Creeks. Access is good through existing roads.</p>

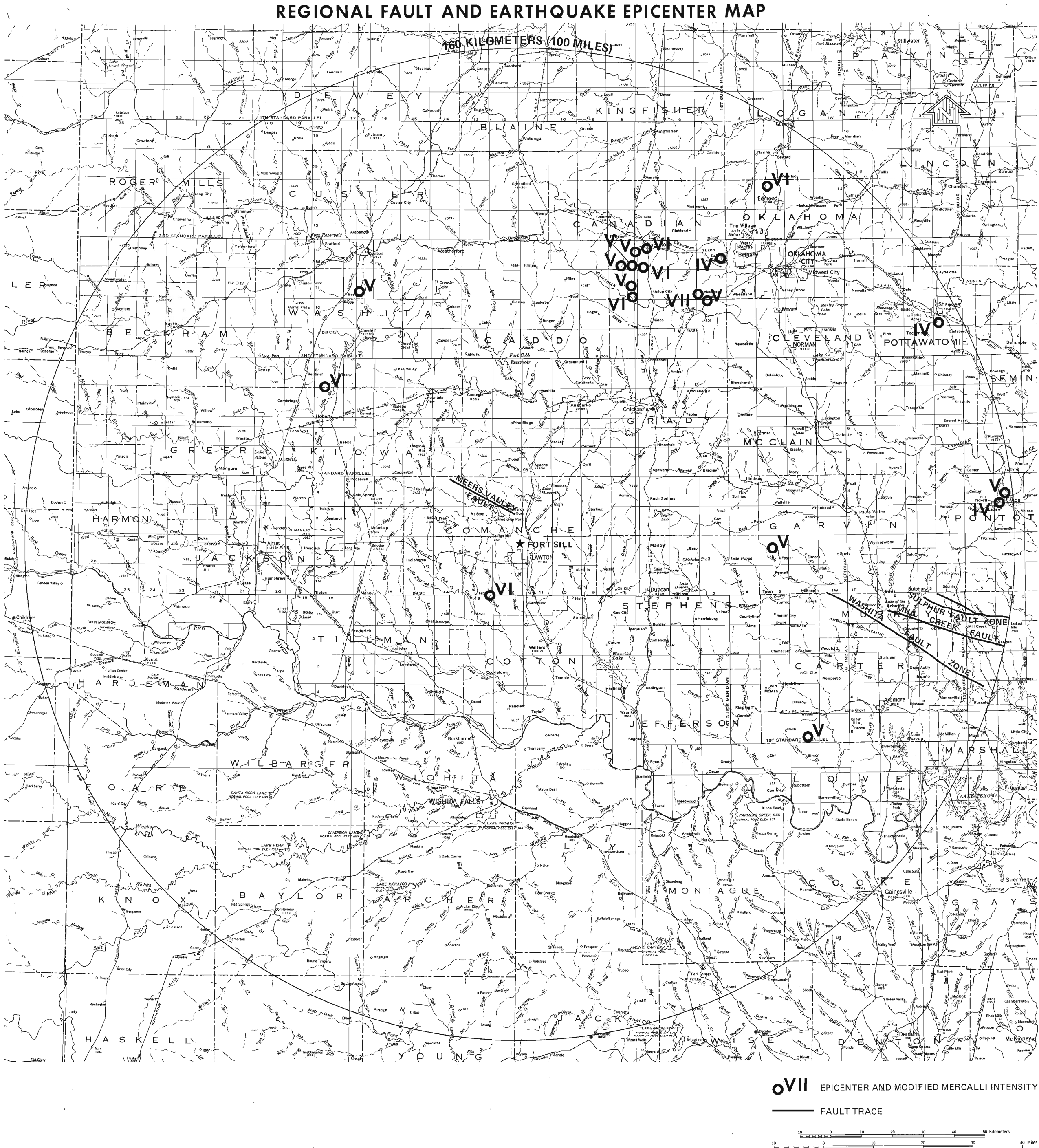
F. SPECIAL PHYSICAL PHENOMENA

EARTHQUAKES

Fort Sill is in a region of low to moderate earthquake activity. There have been 19 recorded earthquakes with maximum intensities of IV or greater (Modified Mercalli Scale) within a 160-kilometer (100-mile) radius of Fort Sill since 1900. These earthquake epicenters are shown on the Regional Fault and Earthquake Epicenter map below, and are listed in the accompanying table. More than half of the known earthquakes in the region have occurred in the vicinity of El Reno in Canadian County, Oklahoma, 105 kilometers (65 miles) north-northeast of Fort Sill. The most intense seismic disturbance in Oklahoma took place near El Reno on 9 April 1952; this Intensity VII shock was felt over an area of about 362,000 square kilometers (139,768 square miles).

During the last 80 years, the closest recorded earthquake was an Intensity VI tremor with epicenter near Faxon in Comanche County, Oklahoma, approximately 19 kilometers (12 miles) south-southwest of the cantonment area. This earthquake occurred on 17 June 1959 and was felt over a large area of southwestern Oklahoma and northern Texas. Slight damage, consisting of cracks in plaster, pavement, and foundations, was reported in Duncan, Cache, and Lawton, Oklahoma. It is possible that the tremors felt at Fort Sill were of Intensity V, probably the greatest ground motion experienced there in recorded history.

The most prominent faults shown on the Regional Fault and Earthquake Epicenter map trend west-northwest. There is no correlation of earthquake activity with the known faulting in the region.

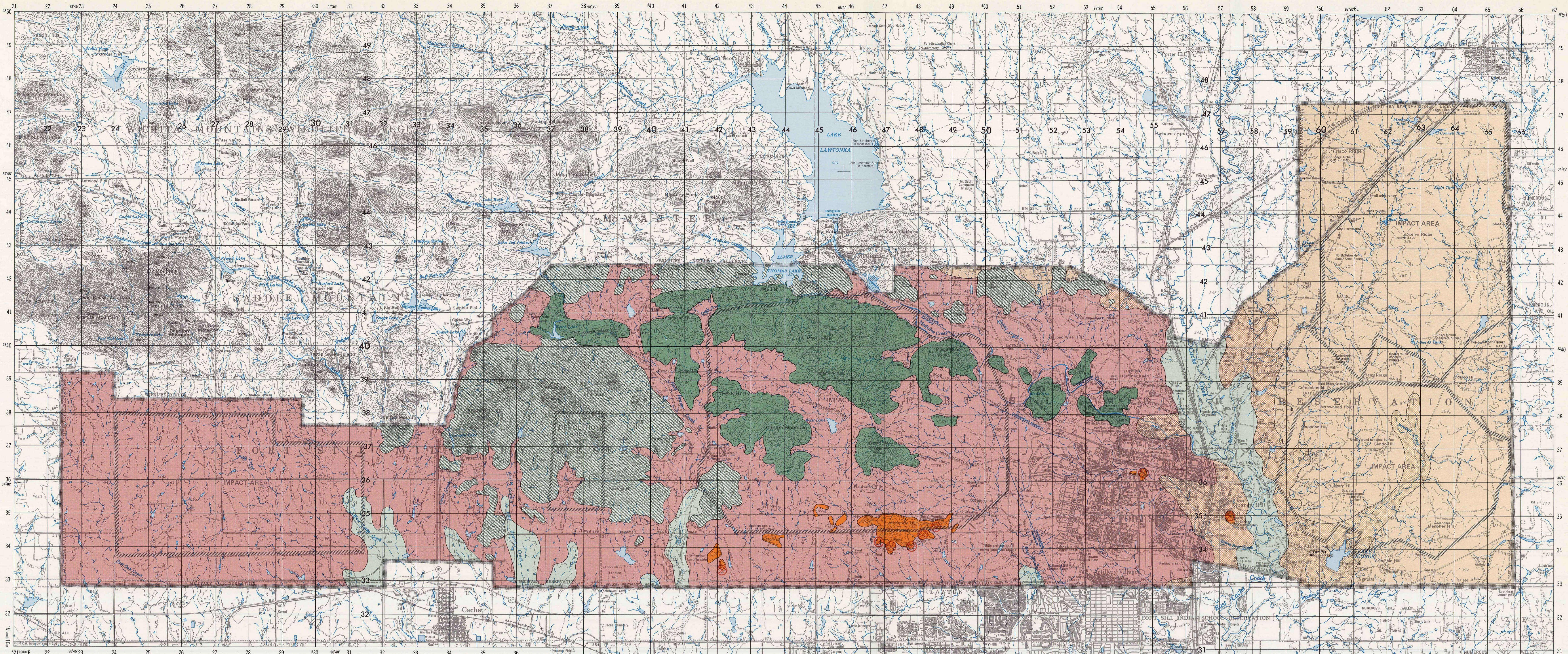


SUMMARY OF INTENSITY IV OR GREATER EARTHQUAKES WITHIN 160-KILOMETER (100-MILE) RADIUS OF FORT SILL (1900-1978)

YEAR	DATE	COUNTY IN OKLAHOMA	NORTH LATITUDE (DEGREES)	WEST LONGITUDE (DEGREES)	MODIFIED MERCALLI INTENSITY
1918	10 Sep	Canadian	35.5	98.0	V
1918	11 Sep	Canadian	35.5	98.0	VI
1918	11 Sep	Canadian	35.5	98.0	VI
1918	—	Canadian	35.5	97.7	IV
1929	27 Dec	Canadian	35.5	98.0	VI
1933	19 Aug	Canadian	35.5	98.0	V
1937	8 Jun	Pottawatomie	35.3	96.9	IV
1941	18 Oct	Washita	35.4	99.0	V
1952	9 Apr	Canadian	35.4	97.8	VII
1952	16 Apr	Canadian	35.4	97.8	V
1953	17 Mar	Canadian	35.4	98.0	V
1953	17 Mar	Canadian	35.4	98.0	VI
1953	6 Jun	Pontotoc	34.8	96.7	IV
1956	16 Feb	Oklahoma	35.7	97.5	VI
1959	15 Jun	Pontotoc	34.8	96.7	V
1959	17 Jun	Comanche	34.5	98.5	VI
1964	2 Feb	Kiowa	35.1	99.1	V
1975	12 Sep	Carter	34.1	97.4	V
1975	29 Nov	Garvin	34.7	97.5	V

MODIFIED MERCALLI INTENSITY (DAMAGE) SCALE OF 1931 (ABRIDGED)

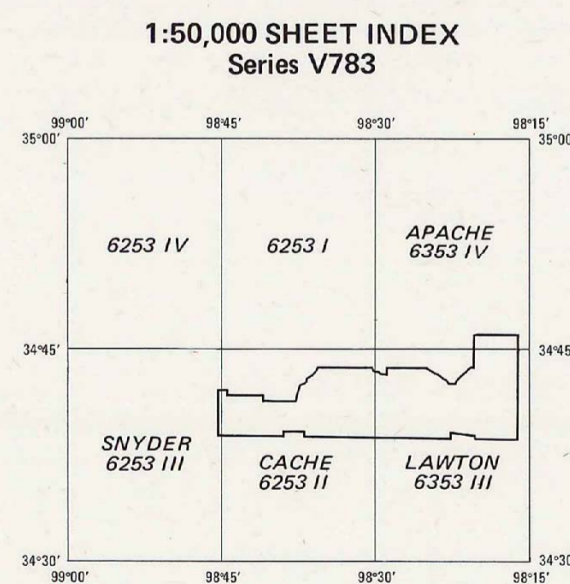
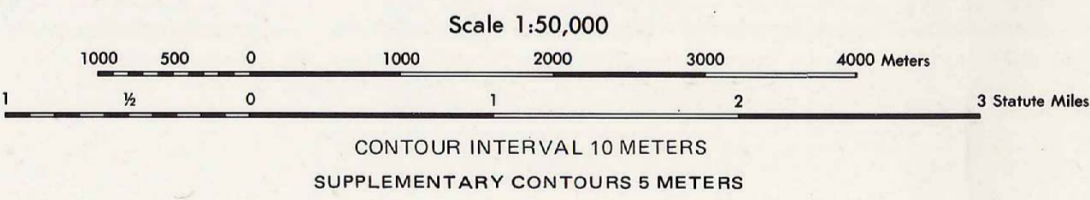
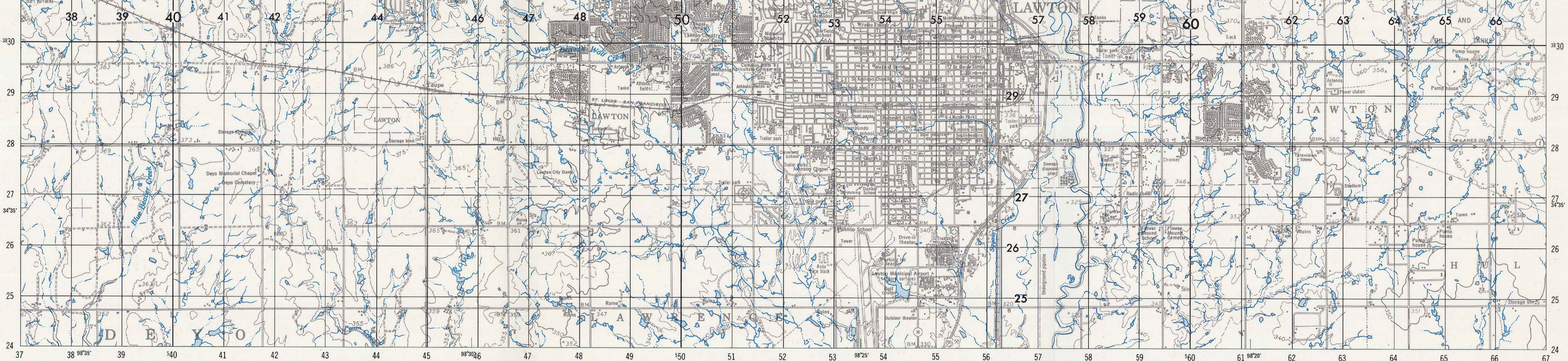
- I. Not felt except by a very few under especially favorable circumstances.
- II. Felt only by a few persons at best, especially on upper floors of buildings. Delicately suspended objects may swing.
- III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated.
- IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.
- V. Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
- VI. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
- VII. Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.



**FORT SILL, OKLAHOMA
TERRAIN ANALYSIS**

ENGINEERING GEOLOGY

- NUMEROUS ENGINEERING USES**
- 1. Granite and rhyolite porphyry conglomerate overlain by sand and gravel.
- SOME ENGINEERING USES**
- 2. Shale with some sandstone.
 - 3. Sandstone and mudstone conglomerate.
 - 4. Limestone, limestone conglomerate, and dolomite.
- FEW ENGINEERING USES**
- 5. Rhyolite and diabase.
 - 6. Granites of various textures.
 - 7. Sand, clay, and gravel.
- NOTE: Number refers to entry in table.
- CONSTRUCTION MATERIALS**
- Abandoned quarry (limestone).



**FORT SILL, OKLAHOMA
TERRAIN ANALYSIS
ENGINEERING GEOLOGY**

G. VEGETATION

Three vegetation types, broadleaf forests, scrublands, and grasslands are significant to military training and operations at Fort Sill.

Deciduous broadleaf forests compose 15 percent of the vegetative cover on the reservation, primarily restricted to flood plain areas. Deciduous broadleaf trees is the primary forest type on the reservation. Approximately 30 percent of the dominant and co-dominant tree cover is the elm, pecan, sugarberry, cottonwood, bur oak, and shumard oak type found along East Cache Creek, Medicine Creek, and Post Oak Creek. The remaining 70 percent of the forest cover consists primarily of the same species, including American elm, slippery elm, pecan, sugarberry, cottonwood, bur oak, and boxelder, in patches in less moist portions of the central and western reservation.

Scrublands consisting of deciduous scrub compose 25 percent of the vegetative cover on the reservation. Deciduous scrub, nearly open to medium spacing, makes up over 70 percent of this vegetation type. The remaining 30 percent of the deciduous scrub is composed of medium to dense vegetation. Major species include mesquite, blackjack oak, post oak, and eastern redcedar. Scrublands are most numerous throughout the central and western portions of the reservation.

Grasslands compose 60 percent of the vegetative cover on the reservation. Both short and tall grass prairie are commonly found. Short grasses predominate in the western half of the reservation and tall

grasses are abundant in the eastern half of the reservation. Tall and short grasses intergrade throughout the central range areas of the installation. Short grass heights range up to 2 meters (6.5 feet) while tall grasses can range up to 3 meters (9.8 feet) or more. Major species include little bluestem, indiagrass, purpletop, spike dropseed, big bluestem, weeping lovegrass, threeawn, and blue and hairy grama. Range fires are common in grassland areas, and if not too frequent, promote grassland development.

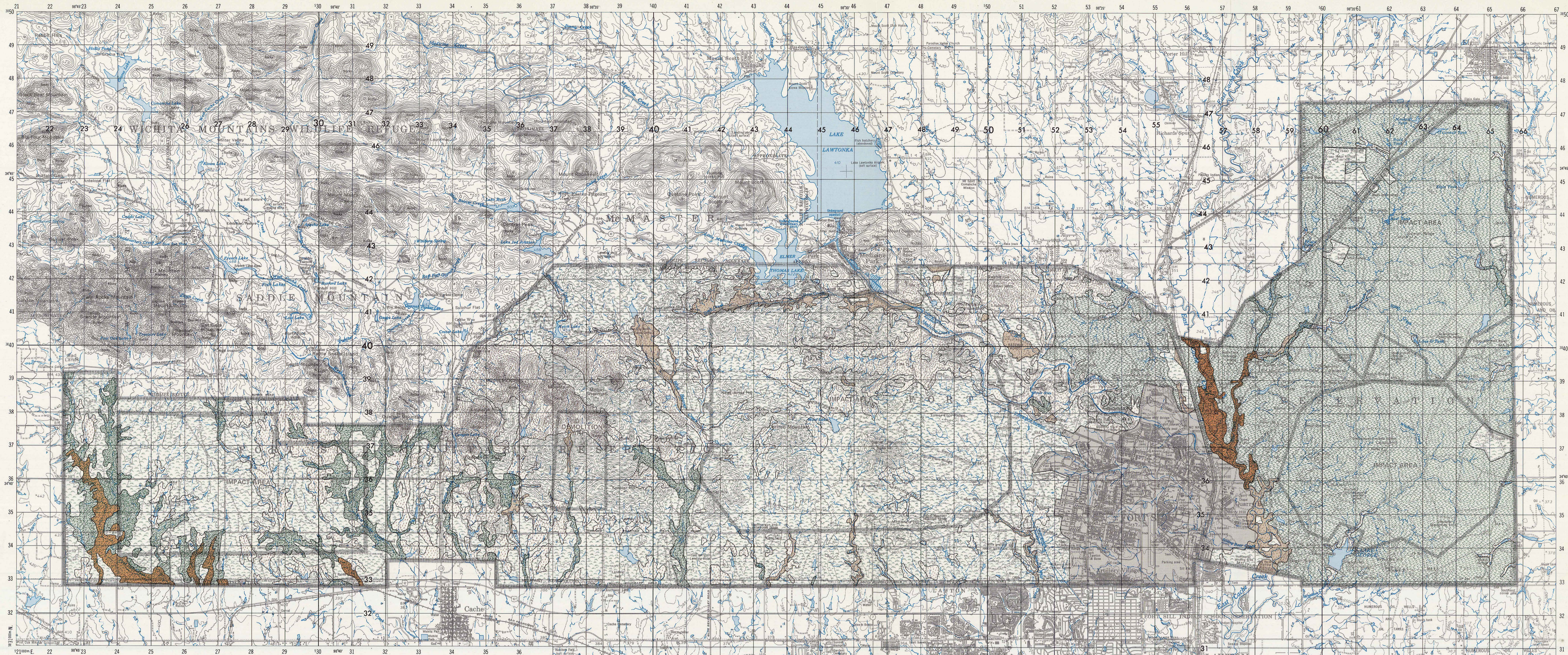
The vegetation type on the reservation which provides the optimum cover for foot troops and vehicles is the dense and medium dense stands of deciduous broadleaf forest. These stands provide excellent cover and concealment potential from late April through late October when the trees are in leaf; excellent cover and fair to good concealment potential exists during the leafless season. Scrubland vegetation, particularly the medium to dense stands, provide some cover and concealment potential. Cover for foot troops is fair to good. Concealment for foot troops during the season when trees are in leaf is good to excellent and moderate during the leafless season. Vehicle concealment during the season when trees are in leaf is fair, and during the leafless season poor to fair depending on location. The vegetation type which provides the least cover and concealment possibilities is the grasslands.

The location and extent of the significant vegetation types on Fort Sill are shown on the accompanying Vegetation map. Descriptive details of each map are included in the table below.

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1. Deciduous broad-leaf trees; medium to dense spacing.	<p>Deciduous (broadleaf) species compose 90 percent or more of each stand. Dominant trees include American and slippery elm, pecan, sugarberry, cottonwood, bur oak, shumard oak, boxelder, and post oak. Spacing between trees averages between 4 to 6 m (13 to 20 ft). Crown cover density is 50 to 100 percent. American and slippery elm, pecan, and sugarberry stem heights average 10 to 19 m (33 to 62 ft). Cottonwood, bur oak, and shumard oak stem heights range from 7 to 18 m (23 to 59 ft). Boxelder and post oak stem heights average from 5 to 18 m (16 to 59 ft). American and slippery elm, pecan, and sugarberry stem diameters range from 23 to 43 cm (9 to 17 in). Cottonwood, bur oak, and shumard oak stem diameters average 28 to 56 cm (11 to 22 in). Boxelder and post oak stem diameters range from 15 to 37 cm (6 to 14.5 in).</p> <p>Undergrowth is moderately dense in most locations; however, it is sparse where crown cover density is above 90 percent. Undergrowth becomes more profuse as crown cover density decreases. Native undergrowth species include green and white ash, roughleaf dogwood, American elder, hawthorn, and honey locust. Undergrowth consisting of probably introduced species includes black locust, autumn olive, osage orange, multiflora rose, sycamore, and weeping willow. Undergrowth heights average 3 m (10 ft) or less except for climbing vines.</p>	Common vegetation type along the flood plains of East Cache, Medicine, and Post Oak Creeks and their tributaries. Also found occasionally in irregular clumps in the foothills of the central and western portions of the reservation. This forest type is found both along streams with expanses of alluvial soils and along streams flowing through rocky areas with steeper gradients and lacking extensive alluvial soils.	This vegetation type includes the largest and densest tree growth on the reservation. Larger trees are not being reproduced at the rate at which they are being lost as the result of field training exercises. Removal of humus and compaction of soil allow for significant erosion in heavily used training areas. Continued erosion and loss of trees appears likely.	Cover for foot troops from flat-trajectory, small arms fire is excellent.	Foot troop concealment is excellent, from both aerial and ground observation when trees are in leaf (late April through late October). During the leafless season, concealment for foot troops is fair to good from both aerial and ground observation. Concealment for vehicles from aerial and ground observation is excellent during the period when trees are in leaf and fair to good during the leafless season, depending on location.
2. Deciduous broad-leaf trees; nearly open to medium spacing.	<p>Deciduous (broadleaf) species compose over 95 percent or more of each stand. Dominant trees include American and slippery elm, pecan, sugarberry, cottonwood, bur oak, and boxelder. Tree spacing ranges from 3 to 7 m (10 to 23 ft). The crown cover density ranges from 10 to 50 percent. American and slippery elm, pecan, and sugarberry stem heights average 8 to 15 m (26 to 49 ft). Cottonwood and bur oak stem heights range from 5 to 12 m (16 to 39 ft). Boxelder stem heights average from 4 to 9 m (13 to 30 ft). American and slippery elm, pecan, and sugarberry stem diameters range from 19 to 30.5 cm (7.5 to 12 in). Cottonwood and bur oak stem diameters average from 18 to 43 cm (7 to 17 in). Boxelder stem diameters range from 11.4 to 33 cm (4.5 to 13 in).</p> <p>Undergrowth generally varies from very sparse to moderately dense, depending on the crown cover density of the dominant species. Common understory species include green and white ash, dogwood, American elder, honey locust, and eastern redcedar. Introduced species in the undergrowth include black locust, autumn olive, osage orange, and multiflora rose. Undergrowth heights average 1.5 to 2.5 m (5 to 8 ft).</p>	Common vegetation type along tributaries and drainageways in the eastern third of the reservation. Found in scattered aggregations on the western third of the reservation. This forest type is found on drier sites than the previous vegetation type.	This vegetation type has a roughly similar composition to the preceding cover type, although it has a more open canopy. The vegetation is more variable in composition with an influx of mesquite found in the association on the southwest portion of the reservation. In addition, post oak and blackjack oak intergrade the association in the mountainous portions of the northwest reservation.	Cover for foot troops from flat-trajectory, small arms fire is good to excellent.	Concealment for foot troops is good to excellent from aerial and ground observation when trees are in leaf (late April through late October). During the leafless season, concealment for foot troops from aerial and ground observation is fair to good, depending on location. Concealment for vehicles from aerial and ground observation is fair to good when trees are in leaf and poor to fair during the leafless season.
3. Deciduous broad-leaf scrub; medium to dense spacing.	<p>Deciduous (broadleaf) species compose 90 percent or more of each stand. Tree species include blackjack oak, post oak, mesquite, eastern redcedar, chinquapin oak, and southern buckthorn. Tree spacing averages 4.5 to 9 m (15 to 30 ft). Crown cover density ranges from 50 to 100 percent. Stem heights generally range from 3.5 to 6 m (11.5 to 20 ft). Stem diameters of the dominants including blackjack oak, post oak, and mesquite range from 9 to 19 cm (3.5 to 7.5 in).</p> <p>Undergrowth is moderate to dense and consists of grass species including little bluestem, indiagrass, purpletop, spike dropseed, big bluestem, and weeping lovegrass. Forbs include western ragweed, heath aster, thistle, plains coreopsis, prairie coneflower, stinging nettle, and prickly pear cactus.</p>	This vegetation type is scattered over the entire reservation though it is found most commonly in the central and west portions. Within the western two-thirds of the reservation, mesquite is found intermingled along the edges of blackjack-post oak thickets. Where drainageways receive more runoff, American and slippery elm, southern buckthorn, sugarberry, and western walnut can be found. Chinquapin oak is found on thicker soil sites at higher elevations.	Deciduous scrub vegetation on the reservation is extremely variable both in composition and location. On the western two-thirds of the reservation, vegetation is limited due to range fires from exploding shells or incendiary devices. Historically in the western portion of the reservation, stock grazing in scrub prevented fire occurrence and resulted in greater dominance of scrub vegetation in this area.	Cover for foot troops from flat-trajectory, small arms fire is fair to good.	Foot troop concealment is good to excellent, from both aerial and ground observation when trees are in leaf (late April through late October). During the leafless season concealment for foot troops is moderate from both aerial and ground observation. Concealment for vehicles from aerial and ground observation is fair during the period when trees are in leaf and poor to fair during the leafless season, depending on location.
4. Deciduous broad-leaf scrub; nearly open to medium spacing.	<p>Deciduous (broadleaf) species compose 95 percent or more of each stand. Dominant tree species include mesquite, blackjack oak, post oak, and eastern redcedar. Crown cover density averages from 10 to 50 percent. Tree spacing ranges from 7.5 to 15 m (25 to 49 ft). Stem diameters of the dominant vegetation average from 5.1 to 16 cm (2 to 6.3 in).</p> <p>Undergrowth is moderate consisting of grass and forb species. Grasses include little bluestem, indiagrass, purpletop, big bluestem, threeawn, and blue and hairy grama. Forbs include western ragweed, wild indigo, plains coreopsis, croton, rosering gaillardia, bitter sneeze-weed, scurfy psoralea, prairie coneflower, and yucca.</p>	This vegetation type is found in a patchwork mosaic over the entire reservation, although it is most frequent on the western two-thirds of the reservation where it intergrades with the deciduous scrub of medium to dense cover. Mesquite is the predominant species of the cover type.	Nearly open to medium spacing deciduous scrub is generally absent from the active impact areas where fires have kept its advance in check.	Cover for foot troops from flat-trajectory, small arms fire is poor to fair.	Foot troop concealment is poor to fair from both aerial and ground observation when trees are in leaf (late April through late October). During the leafless season concealment for foot troops is nonexistent. Concealment for vehicles from aerial and ground observation during the period when trees are in leaf is poor to nonexistent and during the leafless season is nonexistent.

G. VEGETATION (Continued)

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
5. Grasslands; tall grass.	<p>Tall grasslands consist of little bluestem, indiangrass, big bluestem, switchgrass, purpletop, tall dropseed, sand bluestem, and weeping lovegrass. The tall grasses range from 1.5 to 3 m (5 to 10 ft).</p> <p>Herbaceous species found in association with the tall grass include heath aster, wild indigo, plains coreopsis, rosering gaillardia, devilsclaw, scurfy psoralea, prairie coneflower, and cocklebur.</p>	<p>Tall grass prairie predominates in the eastern third of the reservation. Tall grass prairie intermingles with short grass prairie in the east-central portion of the reservation and sporadically over the remainder of the reservation.</p>	<p>This unit is predominantly tall grass with short grass components. Artillery fires periodically burn off the tall grass; however, this action perpetuates the tall grasses in affected areas. A tall grass prairie preserve has been established centered at grid reference 640370.</p>	<p>Cover for foot troops from flat-trajectory, small arms fire is nonexistent.</p>	<p>Concealment for foot troops from aerial observation is nonexistent year-round. Concealment for foot troops from ground observation is poor during spring and early summer and fair to good in late summer and fall. During winter, concealment for foot troops from ground observation is nonexistent. Concealment for vehicles from aerial and ground observation is nonexistent year-round.</p>
6. Grasslands; short grass.	<p>Short grass prairie consists of little bluestem, indiangrass, purpletop, spike dropseed, big bluestem, weeping lovegrass, threeawn, and blue and hairy grama. These grasses generally range from 0.5 to 2 m (1.5 to 6.5 ft), with the average being approximately 1 m (3.2 ft).</p> <p>Shrubs interspersed with the grasslands include mesquite and blackjack and post oak. Herbaceous species include heath aster, wild indigo, rosering gaillardia, bitter sneezeweed, devilsclaw, scurfy psoralea, and prairie coneflower.</p>	<p>Short grass prairie occupies large areas of the western two-thirds of the reservation, where it occurs at all elevations and on all soil types. Short grasses are not a significant component in the east.</p>	<p>This unit is predominantly short grass with tall grass components. Periodic grass fires from exploding and flaming ordnance have eliminated brush and shrubby species with little significant ecological damage to the short grass stage of plant succession.</p>	<p>Cover for foot troops from flat-trajectory, small arms fire is nonexistent.</p>	<p>Concealment for both foot troops and vehicles from aerial and ground observation is nonexistent year-round.</p>



FORT SILL, OKLAHOMA TERRAIN ANALYSIS

VEGETATION

FORESTS

- 1. Deciduous broadleaf trees; medium to dense spacing.
- 2. Deciduous broadleaf trees; nearly open to medium spacing.

SCRUB

- 3. Deciduous broadleaf scrub; medium to dense spacing.
- 4. Deciduous broadleaf scrub; nearly open to medium spacing.

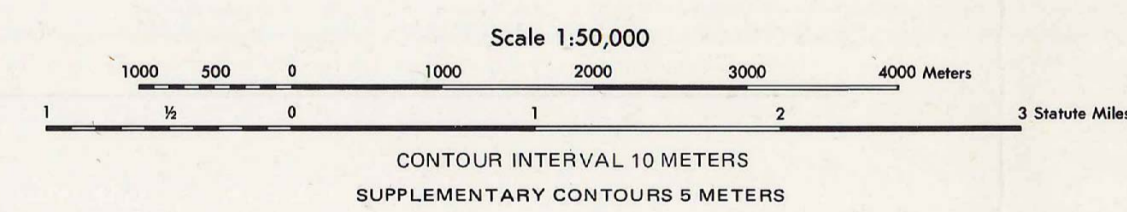
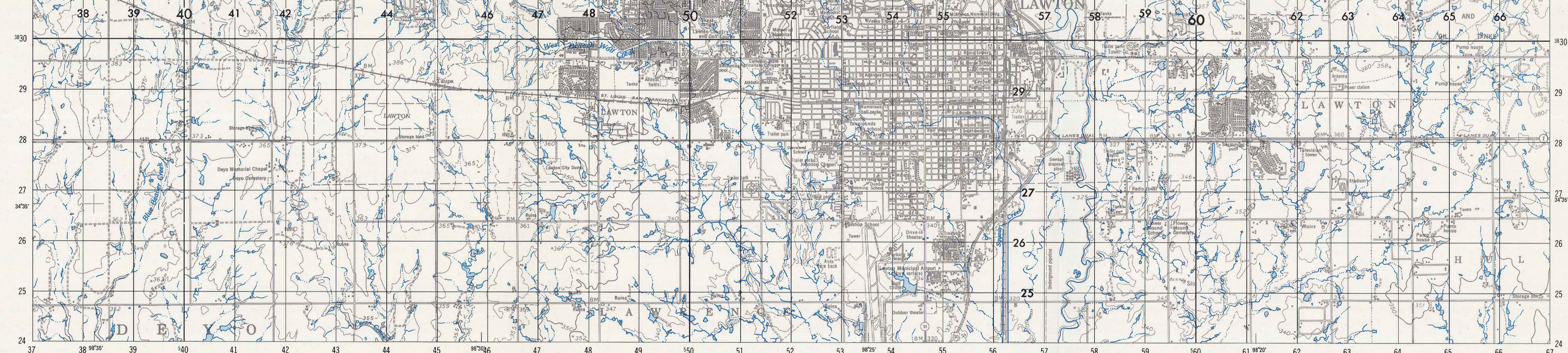
GRASSLANDS

- 5. Tall grass
- 6. Short grass

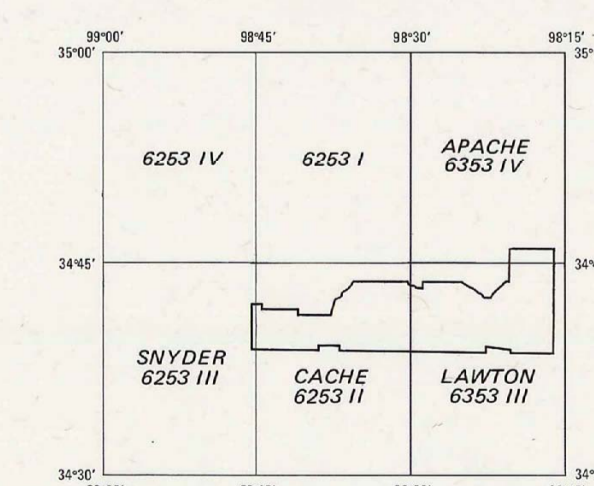
OPEN

- 7. Built-up and heavily used areas. Vegetation is not a significant factor.

NOTE: Number refers to entry in table.



1:50,000 SHEET INDEX Series V783



FORT SILL, OKLAHOMA TERRAIN ANALYSIS VEGETATION

Prepared by Dames & Moore, Washington, DC, under the direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, December 1980.

H. CLIMATE

The climate of Fort Sill, Oklahoma, is predominantly continental, producing pronounced daily and seasonal temperature changes and considerable variations in seasonal and annual precipitation.

Summers are long and hot. Low humidities and southerly breezes usually accompany the high summer temperatures and lessen their discomforting effect. The mean daily maximum temperature in July, the hottest month, is 34.7°C (94.4°F). The highest temperature on record over the 50-year period, 1929 to 1979, was 46.1°C (115°F) in August 1936; in July and August 1934 there were 31 consecutive days when the temperature reached 37.8°C (100°F). Nights are generally comfortable because clear skies and low humidity allow rapid cooling after sunset.

Winters are comparatively mild and short. January, the coldest month, has a mean daily minimum temperature of -2.3°C (27.8°F). Temperatures below 0°C (32°F) are experienced an average of 75 days a year. The lowest temperature recorded over the 50-year period was 23°C (-11°F) in January 1930; in December 1924 the temperature remained continuously below freezing for seven consecutive days.

The average annual precipitation is 789.9 millimeters (31.1 inches), with maximum amounts occurring during May, June, and October, which have average monthly rainfalls of 80.5 to 136.4 millimeters (3.2 to 5.4 inches); minimum amounts occur during January and February when monthly averages are 32.3 to 33.0 millimeters (1.27 to 1.3 inches). The maximum 24-hour precipitation on record during the 50-year period was 199.6 millimeters (7.86 inches) in May 1929. Thunderstorms occur on an average of 40 to 50 days per year. Severe thunderstorms may be accompanied by tornadoes and damaging hail; approximately 75 percent of severe thunderstorms occur during the spring. Snowfall averages 137.2 millimeters (5.4 inches) a year. Snow rarely remains on the ground more than a few days; however, strong winds with heavy snowfalls may cause drifting and occasionally produce hazardous conditions.

Prevailing winds are southerly from April through October and northerly from November through March. The average wind speed is 7.4 knots (13.7 kilometers per hour or 8.5 miles per hour).

The table below summarizes climatic and ephemeral data for Fort Sill, Oklahoma.

CLIMATIC SUMMARY*

FORT SILL (LAWTON), OKLAHOMA		LATITUDE 34°39'N	LONGITUDE 98°24'W		ELEVATION: 361.8 m (1187 ft)										YEARS OF RECORD	
PARAMETER DESCRIPTION	UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL		
Absolute maximum temperature	°C	29.4	30.6	38.3	37.8	41.1	43.9	45.6	46.1	43.3	39.4	31.1	31.1	46.1	50	
	°F	85	87	101	100	106	111	114	115	110	103	88	88	115	50	
Mean daily maximum temperature	°C	9.4	12.6	17.3	22.9	27.1	31.9	34.7	34.3	29.7	24.1	16.4	11.4	22.6	30	
	°F	48.9	54.6	63.1	73.2	80.7	89.4	94.4	93.7	85.4	75.3	61.6	52.6	72.7	30	
Mean daily minimum temperature	°C	-2.3	0.3	4.4	10.6	15.4	20.3	22.5	21.8	20.4	11.3	4.3	-0.4	10.5	30	
	°F	27.8	32.5	39.9	51.0	59.7	68.5	72.5	71.2	68.8	52.3	39.7	31.3	50.9	30	
Absolute minimum temperature	°C	-23.9	-19.4	-14.4	-5.6	-1.1	7.2	11.7	7.8	1.7	-8.9	-11.1	-17.8	-23.9	50	
	°F	-11	-3	6	22	30	45	53	46	35	16	12	0	-11	50	
Mean number days with maximum temperature ≥ 32.2°C (90°F)	days	0	0	#	2	6	20	28	27	17	4	0	0	104	30	
Mean number days with minimum temperature ≤ 0.0°C (32°F)	days	21	14	9	1	0	0	0	0	0	1	10	19	75	30	
Normal heating degree days (base 18.3°C/65°F)	days	784	574	437	123	15	0	0	0	0	108	412	694	3147	30	
Normal cooling degree days (base 18.3°C/65°F)	days	0	0	16	60	186	417	567	561	309	87	0	0	2203	30	
Mean dew point temperature	°C	-1.7	0.0	1.7	7.2	14.4	18.3	19.4	17.8	14.4	9.4	1.7	-1.7	8.3	12	
	°F	29	32	35	45	58	65	67	64	58	49	35	29	47	12	
Mean percent relative humidity	%	70	67	61	60	68	65	63	58	58	63	63	66	64	12	
Mean precipitation	mm	32.3	33.0	43.2	74.2	136.4	92.7	70.6	64.8	77.7	80.5	42.9	40.9	789.9	50	
	in	1.27	1.30	1.70	2.92	5.37	3.65	2.78	2.55	3.06	3.17	1.69	1.61	31.1	50	
Mean number days with precipitation ≥ 2.54 mm (0.1 in)	days	3.3	3.4	4.3	6.0	7.3	6.4	5.3	5.0	5.1	5.2	3.2	3.9	58.4	50	
Absolute maximum precipitation	mm	135.9	126.0	175.0	166.9	375.4	276.4	187.2	168.4	230.6	293.4	177.0	115.1	1126.7	50	
	in	5.35	4.96	6.89	6.57	14.78	10.88	7.37	6.63	9.08	11.55	6.97	4.53	44.36	50	
Absolute minimum precipitation	mm	T	T	T	1.8	15.8	5.6	2.3	0.0	0.0	T	0.0	T	439.7	50	
	in	T	T	T	0.07	0.62	0.22	0.09	0.00	0.00	T	0.00	T	17.31	50	
Absolute maximum 24 hr precipitation	mm	53.6	52.1	71.1	66.0	199.6	128.3	97.8	68.6	106.7	186.2	66.0	70.4	199.6	50	
	in	2.11	2.05	2.80	2.60	7.86	5.05	3.85	2.70	4.20	7.33	2.60	2.77	7.86	50	
Mean number days with thunderstorms	days	0.3	1.1	2.7	4.5	9.5	6.3	7.0	4.9	3.3	3.0	1.1	0.7	44.4	12	
Mean snowfall	mm	63.5	33.0	17.8	2.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	17.8	137.2	30	
	in	2.5	1.3	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	5.4	30	
Mean number days with snowfall ≥ 38.1 mm (1.5 in)	days	0.6	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.7	12	
Absolute maximum snowfall	mm	363.2	421.6	248.9	81.3	0.0	0.0	0.0	0.0	0.0	0.0	55.9	254.0	627.4	30	
	in	14.3	16.6	9.8	3.2	0.0	0.0	0.0	0.0	0.0	0.0	2.2	10.0	24.7	30	
Mean pressure altitude	m	304.8	313.6	339.9	355.7	363.9	367.3	352.0	352.3	341.4	328.9	310.9	303.0	336.2	12	
	ft	1000	1029	1115	1167	1194	1205	1155	1156	1120	1079	1020	994	1103	12	
Mean wind speed	knots	7.6	8.1	9.3	8.9	7.6	7.5	6.0	5.8	6.0	7.1	7.4	7.4	7.4	10	
	kmph	14.1	15.0	17.2	16.5	14.1	13.9	11.1	10.7	11.1	13.2	13.7	13.7	13.7	10	
	mph	8.8	9.3	10.7	10.2	8.8	8.6	6.9	6.7	6.9	8.2	8.5	8.5	8.5	10	
Prevailing wind direction		N	N	N	SSE	SSE	S	S	S	S	S	N	N	S	10	
Fastest one minute wind speed	knots	44.2	44.8	44.0	47.0	48.1	45.9	38.9	38.3	40.3	38.3	41.4	41.3	48.1	10	
	kmph	81.9	83.0	81.5	87.0	89.1	85.0	72.0	70.9	74.6	70.9	76.7	76.5	89.1	10	
	mph	50.9	51.6	50.6	54.1	55.4	52.8	44.8	44.1	46.4	44.1	47.7	47.5	55.4	10	
Percent frequency of surface wind speed ≥ 28 knots (51.9 kmph or 32.24 mph)	%	0.8	1.6	2.6	1.2	0.6	0.4	0.1	0.0	0.1	0.3	0.7	0.8	0.8	12	
Percent frequency of surface wind speed ≥ 17 knots (31.5 kmph or 19.58 mph)	%	12.7	16.9	20.4	22.4	14.3	14.8	8.6	5.3	9.3	10.6	13.3	12.2	13.4	12	
Mean number days with surface wind ≥ 17 knots (31.5 kmph or 19.58 mph) and no precipitation	(At 1700 LST)	days	4.0	6.3	8.2	8.5	6.3	6.5	5.0	2.7	5.0	4.0	4.2	3.3	64.0	12
	(At 2300 LST)	days	3.1	3.1	4.6	5.3	3.3	2.9	1.2	1.1	2.3	2.0	2.6	2.9	34.4	12
	(At 0500 LST)	days	2.7	3.6	4.2	3.4	2.2	1.7	0.7	0.1	0.8	1.1	2.8	2.6	25.9	12
	(At 1100 LST)	days	6.1	6.8	8.9	9.3	6.4	6.5	4.1	2.7	4.7	5.8	6.0	6.1	73.4	12
Mean number days with surface wind 4 to 10 knots (7.4 to 18.5 kmph or 4.61 to 11.52 mph) and temperature 0.6° to 31.7°C (33° to 89°F) and no precipitation	(At 1700 LST)	days	11.9	10.2	8.6	8.1	10.8	6.8	5.4	5.1	7.3	13.5	13.4	13.1	114.2	12
	(At 2300 LST)	days	7.4	9.0	10.2	11.5	13.5	13.5	16.8	15.2	13.4	12.3	9.6	8.3	140.7	12
	(At 0500 LST)	days	5.3	6.6	9.4	11.7	13.9	12.8	12.8	12.9	12.3	10.3	8.3	6.7	123.0	12
	(At 1100 LST)	days	7.9	7.8	7.5	7.4	11.5	8.2	9.0	9.8	10.7	11.5	11.1	10.1	112.5	12
Mean number days with an occurrence of visibility ≤ 0.8 km (0.5 mi)	days	3.7	3.2	2.1	0.8	0.7	0.4	0.2	0.0	0.3	1.0	1.6	2.7	16.7	12	
Percent frequency ceiling ≤ 1524 m (5000 ft) or visibility ≤ 8.05 km (5 mi)	%	22.9	28.0	25.2	22.8	23.2	14.8	11.1	7.2	12.3	17.0	17.0	18.7	18.4	12	
Percent frequency ceiling ≤ 457.2 m (1500 ft) or visibility ≤ 4.83 km (3 mi)	(for 0000-0200 LST)	%	13.4	17.0	11.8	7.1	8.1	3.2	1.5	0.2	2.8	7.5	8.5	10.8	7.7	12
	(for 0300-0500 LST)	%	16.9	18.2	14.2	10.2	11.3	4.4	3.1	1.0	6.1	9.5	11.9	13.8	10.1	12
	(for 0600-0800 LST)	%	20.1	21.6	17.3	13.8	15.2	7.0	6.0	3.5	10.7	12.0	14.6	15.5	13.1	12
	(for 0900-1100 LST)	%	19.8	21.1	16.5	12.4	12.6	5.6	4.1	3.1	8.1	11.9	12.8	15.8	12.0	12
	(for 1200-1400 LST)	%	14.2	17.2	12.6	5.7	8.1	2.7	1.8	0.9	3.1	6.7	8.1	11.1	7.7	12
	(for 1500-1700 LST)	%	10.4	12.7	10.7	3.8	6.0	1.1	1.2	0.6	1.9	4.6	6.6	8.3	5.7	12
	(for 1800-2000 LST)	%	10.2	11.0	11.6	4.9	5.2	2.1	0.9	0.4	2.7	4.9	7.9	7.9	5.8	12
	(for 2100-2300 LST)	%	10.7	13.5	11.0	5.5	5.3	2.8	0.8	0.2	3.1	5.2	8.0	8.4	6.2	12
		%	4.9	5.0	2.3	0.8	1.0	0.5	0.1	0.0	0.0	1.2	2.1	3.9	1.8	12
Percent frequency ceiling ≤ 91.4 m (300 ft) or visibility ≤ 1.61 km (1 mi)	(for 0300-0500 LST)	%	7.4	6.7	4.3	1.9	1.7	0.8	0.1	0.0	0.8	1.8	3.5	5.7	2.9	12
	(for 0600-0800 LST)	%	8.3	8.2	3.4	2.8	1.5	0.3	0.4	0.0	1.2	2.2	4.9	6.1	3.3	12
	(for 0900-1100 LST)	%	5.5	5.6	2.1	0.3	0.5	0.0	0.0	0.0	0.2	1.8	1.5	4.3	1.8	12
	(for 1200-1400 LST)	%	2.1	1.1	1.3	0.2	0.3	0.1	0.1	0.0	0.0	0.4	0.5	1.2	0.6	12
	(for 1500-1700 LST)	%	1.7	1.8	2.3	0.3	0.3	0.1	0.0	0.0	0.1	0.4	1.3	0.7	0.8	12
	(for 1800-2000 LST)	%	1.7	1.5	2.5	0.5	0.3	0.7	0.1	0.0	0.0	0.3	1.1	1.3	0.8	12
	(for 2100-2300 LST)	%	3.4	3.4	2.3	0.1	0.4	0.1	0.0	0.0	0.3	0.5	1.6	3.2	1.3	12
		%	4.9	5.0	2.3	0.8	1.0	0.5	0.1	0.0	0.0	1.2	2.1	3.9	1.8	12
		%	7.4	6.7	4.3	1.9	1.7	0.8	0.1	0.0	0.8	1.8	3.5	5.7	2.9	12
Mean number days with sky cover ≤ 30 percent and visibility ≥ 4.83 km (3 mi)	(At 1700 LST)	days	10.8	8.5	10.5	10.6	9.4	11.4	8.9	10.0	15.0	15.9	14.3	13.0	138.3	12
	(At 2300 LST)	days	14.7	13.2	15.8	14.8	14.4	16.8	19.5	21.5	21.2	20.4	18.8	19.5	210.6	12
	(At 0500 LST)	days	13.8	12.5	15.5	13.1	9.1	11.0	13.1	16.8	18.4	19.3	18.2	17.0	177.8	12
	(At 1100 LST)	days	9.6	8.5	10.1	9.2	8.9	10.8	10.5	12.9	14.9	15.5	1			

H. CLIMATE (Continued)

CLIMATIC SUMMARY (Continued)*

FORT SILL (LAWTON), OKLAHOMA			LATITUDE 34°39'N		LONGITUDE 98°24'W		ELEVATION: 361.8 m (1187 ft)										YEARS OF	
PARAMETER DESCRIPTION		UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	RECORD		
Mean number days with ceiling ≥ 609.6 m (2000 ft) and visibility ≥ 4.83 km (3 mi) and surface wind ≤ 10 knots (18.5 kmph or 11.5 mph)	(At 1700 LST)	days	12.4	8.2	7.9	6.3	10.3	9.9	11.2	12.5	11.0	12.2	12.9	14.9	129.7	12		
	(At 2300 LST)	days	15.8	12.5	12.4	13.0	16.5	15.6	19.6	20.5	16.7	17.9	16.4	17.4	194.3	12		
	(At 0500 LST)	days	15.2	12.3	13.1	12.7	17.4	18.8	22.4	25.5	20.1	18.7	17.3	16.6	210.1	12		
	(At 1100 LST)	days	9.1	6.9	6.5	5.8	9.2	9.9	12.7	13.6	10.6	8.4	9.7	10.9	113.3	12		
Mean number days with ceiling ≥ 762.0 m (2500 ft) and visibility ≥ 4.83 km (3 mi)	(At 1700 LST)	days	26.5	23.0	25.8	27.6	28.3	29.2	30.2	30.6	29.3	28.5	27.1	27.6	333.7	12		
	(At 2300 LST)	days	26.5	23.0	26.2	27.8	28.3	28.7	30.5	30.8	28.2	28.9	26.8	27.4	333.1	12		
	(At 0500 LST)	days	24.9	21.1	24.8	24.9	25.8	27.9	29.1	30.5	27.1	26.9	25.4	25.5	313.9	12		
	(At 1100 LST)	days	23.7	21.1	24.4	24.9	25.1	27.0	28.8	29.5	26.9	26.3	25.2	25.0	307.8	12		
Mean number days with ceiling ≥ 1828.8 m (6000 ft) and visibility ≥ 4.83 km (3 mi)	(At 1700 LST)	days	24.4	20.8	22.9	23.6	24.5	25.1	27.2	28.6	26.9	26.0	25.7	25.5	301.2	12		
	(At 2300 LST)	days	24.7	21.4	24.6	25.2	26.0	27.2	28.9	29.6	27.2	27.1	25.9	26.4	314.2	12		
	(At 0500 LST)	days	22.7	18.6	22.9	22.9	23.1	25.5	26.8	28.6	25.9	24.7	23.3	23.8	288.8	12		
	(At 1100 LST)	days	22.5	19.2	22.2	20.3	21.3	23.6	24.8	27.6	24.5	24.7	23.9	23.1	277.7	12		
Mean number days with ceiling ≥ 3048.0 m (10,000 ft) and visibility ≥ 4.83 km (3 mi)	(At 1700 LST)	days	22.9	20.0	22.0	22.7	23.3	24.2	26.2	27.4	25.8	24.9	24.7	24.8	288.9	12		
	(At 2300 LST)	days	23.4	20.6	23.7	24.0	25.0	25.7	28.0	29.2	26.5	26.3	24.8	25.5	302.7	12		
	(At 0500 LST)	days	21.6	17.6	22.1	21.8	21.4	24.3	25.2	27.3	25.0	23.7	22.6	22.8	275.4	12		
	(At 1100 LST)	days	21.4	18.2	21.0	19.7	20.0	22.1	23.7	26.9	24.1	23.6	23.3	22.2	266.2	12		

*NOTE: # = less than 0.5 day; T – trace; LST = Local Standard Time.

EPHEMERIS FOR FORT SILL, OKLAHOMA
(CENTRAL STANDARD TIME)

NAUTICAL TWILIGHT					NAUTICAL TWILIGHT					NAUTICAL TWILIGHT					NAUTICAL TWILIGHT				
DATE	BEGINNING	END	SUNRISE	SUNSET	DATE	BEGINNING	END	SUNRISE	SUNSET	DATE	BEGINNING	END	SUNRISE	SUNSET	DATE	BEGINNING	END	SUNRISE	SUNSET
January 1	0641	1833	0741	1734	April 1	0526	1950	0621	1855	July 1	0418	2056	0524	1951	October 1	0534	1911	0628	1818
January 11	0643	1841	0741	1742	April 11	0511	1959	0608	1902	July 11	0424	2053	0529	1949	October 11	0541	1859	0636	1804
January 21	0641	1850	0739	1752	April 21	0457	2008	0555	1910	July 21	0432	2047	0535	1944	October 21	0549	1847	0644	1752
February 1	0635	1859	0732	1803	May 1	0444	2018	0544	1918	August 1	0442	2037	0543	1936	November 1	0558	1836	0654	1740
February 11	0628	1908	0724	1813	May 11	0433	2027	0534	1926	August 11	0451	2025	0551	1926	November 11	0607	1828	0703	1732
February 21	0618	1917	0713	1822	May 21	0424	2037	0527	1934	August 21	0501	2012	0558	1915	November 21	0615	1824	0713	1726
March 1	0609	1924	0703	1829	June 1	0417	2046	0522	1941	September 1	0510	1956	0606	1900	December 1	0623	1822	0722	1723
March 11	0556	1932	0650	1838	June 11	0414	2052	0520	1946	September 11	0518	1942	0613	1846	December 11	0631	1823	0730	1723
March 21	0542	1940	0638	1846	June 21	0415	2056	0521	1950	September 21	0526	1927	0621	1832	December 21	0637	1826	0737	1727

I. CROSS-COUNTRY MOVEMENT

MAP UNIT	GENERAL TERRAIN CONDITIONS*	MOVEMENT OF TRACKED VEHICLES†	MOVEMENT OF WHEELED VEHICLES‡	MOVEMENT OF FOOT TROOPS
1. Nearly level to gently rolling, short grass prairie.	<p>Nearly level to gently rolling, short grass prairie is scattered throughout the central and western portions of the reservation. Most slopes are less than 8 percent; some slopes are as high as 15 percent. Soils vary from sands with some gravels to silts and clays; all soils have generally good bearing strength when dry, but clays may become soft and slippery when wet. Streams are narrow, shallow, and intermittent.</p> <p>Manmade features near Lake Elmer Thomas Recreation Area (grid reference 445420), powerlines, and the State Highway 115 right-of-way may be impediments. Near-surface, underground aqueducts extend from Medicine Park across the reservation to the cantonment area and the City of Lawton. (See Section J, Lines of Communication, for additional information.)</p>	<p>Movement generally easy in any direction. Clayey soils could slow movement when wet. Dust problems can be anticipated during maneuvers in dry weather, particularly in areas where grass cover is thin and soils have been loosened by previous vehicular traffic.</p> <p>Underground pipelines should be avoided unless crossing sites are approved.</p>	<p>Movement generally easy in any direction, although tires may sink in loose sand. Clayey soils could slow movement when wet. Dust problems can be anticipated during maneuvers in dry weather, particularly in areas where grass cover is thin and soils have been loosened by previous vehicular traffic. Cloudbursts could hinder mobility at stream crossings.</p>	<p>Movement unhindered in any direction.</p>
2. Nearly level to gently rolling, tall grass prairie.	<p>Nearly level to gently rolling tall grass prairie dominates the eastern portion of the reservation. Grass heights range from 1.5 to 3 m (5 to 10 ft). Most slopes are less than 8 percent; some slopes are as high as 15 percent. Soils are largely silts and clays with some sand; severe erosion in some areas could hamper movement. Streams are narrow, shallow, and intermittent; a few stream valleys have steep, eroded walls.</p> <p>Highway and railroad rights-of-way transect the unit, and gas and oil wells near the eastern boundary are impediments.</p>	<p>Movement generally easy when soils are dry. Clayey soils could slow movement during wet periods. Deeply eroded gullies may require detours.</p>	<p>Movement generally easy when soils are dry, although vision may be impaired by high vegetation in summer and fall. Vehicles could mire during wet periods. Deeply eroded gullies will require detours.</p>	<p>Movement is slightly slowed by tall vegetation.</p>
3. Nearly level to gently rolling, scrub-covered plains.	<p>Nearly level to gently rolling scrub-covered plains are scattered throughout the reservation. Stem diameters range from 5 to 19 cm (2 to 7.5 in). Tree spacing is 5 to 15 m (16 to 49 ft) with moderate to dense undergrowth. Slopes are less than 15 percent. Soils vary from silts and clays, in the eastern and central parts of Fort Sill and along small streams, to sands and gravels in upper drainage basins and the western part of the reservation. Streams generally are small; however, crossing some streams will be hazardous following locally intense rainfall.</p>	<p>Movement somewhat slowed by woody vegetation; trees can generally be maneuvered around or pushed over. Clayey soils may be an additional hindrance during wet periods. Occasional flooding locally may present obstacles.</p>	<p>Movement moderately slowed by woody vegetation. Clayey soils may be an additional hindrance during wet periods. Occasional flooding could limit local movement. Visibility somewhat impaired in locally dense vegetation.</p>	<p>Movement easy in open areas. Slightly slowed by vegetation and occasional flooding.</p>
4. Moderately rolling, short grass- and scrub-covered uplands.	<p>Moderately sloping uplands occur principally in the central portion of the reservation. Vegetation varies from short grasses to locally dense deciduous scrub. Slopes range from 15 to 30 percent. Predominantly thin, coarse-grained soils have generally good bearing strength; many areas have rock outcrops. Streams are generally small, but crossing could be hazardous following locally intense rainfall.</p>	<p>Movement impaired slightly on moderate slopes. Vegetation and soils have little effect. Small, local escarpments along Deer and West Cache Creeks require detours.</p>	<p>Moderate slopes impede movement, particularly when soils are wet. Small, local escarpments along Deer and West Cache Creeks require detours.</p>	<p>Movement generally easy in open areas. Slightly to moderately slowed by moderate slopes and locally dense scrub.</p>
5. Nearly level to gently rolling, densely wooded plains.	<p>Nearly level to gently rolling, densely wooded flood plains occur predominantly in the western portion of the reservation and along East Cache Creek. Stem diameters range from 11.4 to 56 cm (4.5 to 22 in). Tree spacing ranges from 3 to 7 m (10 to 23 ft). Undergrowth is moderately dense in most locations. Most slopes are less than 8 percent, but locally may be as high as 15 percent. Soils are largely silts and clays, which are firm when dry, but are slick when wet. Streams are generally shallow, but crossing could be hazardous following locally intense rainfall.</p> <p>Unfenced sewage lagoons near Camp Eagle (grid reference 344363) should be avoided.</p>	<p>Movement considerably slowed by dense vegetation. Miring creates additional hindrance during wet seasons. Occasional flooding could limit local movement.</p>	<p>Movement severely hindered by dense vegetation. Soft, slick soils restrict movement during wet periods. Flooding prohibits local movement.</p>	<p>Movement slightly to moderately slowed by dense vegetation; wet soils and swift currents at stream crossings following intense rainfall are additional constraints.</p>
6. Moderately to strongly rolling, grass- and scrub-covered uplands.	<p>Moderately to strongly rolling uplands are scattered throughout the central portion of the reservation. Dominant vegetation is short grass with local areas of deciduous scrub. Slopes generally range between 30 and 60 percent, but locally may exceed 100 percent. Soil cover is thin, mostly sand and gravel, with numerous rock outcrops.</p>	<p>Movement generally difficult due to steep slopes, rock outcrops, and loose, rocky soils. Short, steep slopes and exposed rock require detours.</p>	<p>Movement not practical due to steep slopes, rock outcrops, and loose, rocky soils.</p>	<p>Movement slow but not difficult; limitations due to steep slopes, rock outcrops, and loose soil.</p>
7. Very steep terrain associated with granite outcrops and rocky escarpments.	<p>Steep slopes, bare rock, boulders, and talus slopes are clustered in the area near Cross Mountain (grid reference 371387), with other locations scattered across the central portion of the reservation. Sparse scrub vegetation grows in small soil pockets and along bedrock fractures. Some slopes of 30 to 45 percent may be found in bare rock, however, most slopes exceed 45 percent; escarpments below Ketch Lake (grid reference 373400) and at Medicine Bluffs (grid reference 535380) have slopes greater than 100 percent. Soil cover is thin, mostly sand and gravel, with numerous rock outcrops.</p> <p>(See Section A, Surface Configuration, for a photograph of Medicine Bluffs.)</p>	<p>Movement generally prohibited by steep slopes, rock outcrops, and loose, rocky soils. Rocky escarpments form insurmountable barriers.</p>	<p>Steep slopes and rocky escarpments form insurmountable barriers.</p>	<p>Movement hindered significantly by steep slopes, rock outcrops, and loose soil. Escarpments below Ketch Lake and at Medicine Bluffs can be scaled only by troops experienced in rock climbing techniques.</p>

*Movement conditions will be degraded for several days following heavy rains, due to soft or slippery soils. Soils dry quickly after a rain due to rapid runoff and fairly high evapotranspiration rate. Most rains come during the months of May, June, and October. In midsummer, precipitation comes in cloudbursts; precipitation during the winter months is low and bearing strength of the soil generally remains high. Snow at Fort Sill is seldom a limiting factor in cross-country movement.

†Comments apply to the M-60 tank and the M-113 armored personnel carrier.

‡Comments apply to the M-35, 2½-ton truck and the M-151, ¼-ton truck.

J. LINES OF COMMUNICATION

INTRODUCTION

Lines of Communication at Fort Sill are depicted on the accompanying map. Supporting information is provided in the tables following this summary.

ROADS

Over 774 kilometers (481 miles) of the roads on Fort Sill are portrayed on the Lines of Communication map. These roads include 220 kilometers (136 miles) of paved roads, 72 kilometers (45 miles) of gravel roads, and over 482 kilometers (300 miles) of improved and unimproved dirt roads. Most of the roads outside the cantonment area and connecting through routes in the cantonment area were selected to represent the road patterns on the map and in the table. Designated tank trails on the reservation are limited to the cantonment area, although most of the dirt roads outside the cantonment can be used by tanks. Asphalt cantonment roads which are built to handle tank traffic have concrete turning pads at road intersections to protect the pavement.

U.S. Highways 62, 277, and 281 traverse the east-central portion of the reservation in a north-south direction in a single right-of-way. State Highway 115 crosses the west-central portion of the reservation in a north-south direction, limiting direct access to the western (Quanah) range.

There are 6 bridges and 38 fords on the reservation. Fords are described in Section B, Surface Drainage.

RAILROADS

Fort Sill has approximately 16 kilometers (10 miles) of U.S. Government-owned track, including a condemned spur line to Henry Post Army Airfield. (See the Railroad Sidings Enlargement under Section 2, Railroads.) The main trackage serves all major warehouses and the Ammunition Storage Area. Two main railroad lines traverse the reservation east of the cantonment area: the Chicago, Rock Island, and Pacific Railroad and the St. Louis-San Francisco Railroad. The Chicago, Rock Island, and Pacific Railroad parallels U.S. Highway 277 for its entire length of 6.8 kilometers (4.2 miles) across the reservation. The St. Louis-San Francisco Railroad also parallels U.S. Highway 277 for much of its 12.9 kilometers (8 miles) across the reservation; however, near the northern cantonment area the railroad turns northeast, leaves the reservation and parallels a portion of the reservation boundary, then re-enters the reservation, cutting across the northwest corner of the east range. Although Government-owned tracks are connected to the Chicago, Rock Island, and Pacific Railroad, traffic in the installation is from the St. Louis-San Francisco Railroad via a short connector line between the two tracks. The Chicago, Rock Island, and Pacific Railroad is bankrupt and is in the process of liquidation. There are four bridges on the Chicago, Rock Island, and Pacific line and eight bridges on the St. Louis-San Francisco line.

AIRFIELDS

Fort Sill has one airfield, Henry Post Army Airfield, which is within the cantonment area. The airfield is used by both fixed-wing and rotary-wing aircraft. There is one paved runway; two sod runways are used when conditions preclude safe use of the main runway. Nine nonoperational airstrips on the reservation function as helicopter landing zones (see Section 5, Helicopter Landing Zones).

PIPELINES

Thirteen pipelines cross the reservation: eight contain water and five contain natural gas, one from two small production wells in the northeast corner of the reservation. Pipe dimensions and number of buried pipes vary within each right-of-way. Seven waterlines west of the cantonment run north-south; all but one belongs to the City of Lawton, the other belongs to Fort Sill. The eighth waterline is east of the cantonment and runs north-south. Two gasline rights-of-way follow the St. Louis-San Francisco Railroad, with a branch line into the cantonment, and one parallels the southern boundary for a short distance.

HELICOPTER LANDING ZONES

Fort Sill has 19 helicopter landing zones. Nine landing zones utilize inactive grass airstrips, one an active sod airstrip, and nine are hard surfaced pads. Henry Post Army Airfield employs and maintains a large contingent of rotary-wing aircraft. Helicopters may use the main runway, parallel taxiway, and sod runways 12-30 and 08-26, time and conditions permitting. Helicopter parking areas are along the main apron and on designated helicopter hardstands.

DROP ZONES

Fort Sill has one active drop zone at Southeast Corner Airfield (inactive). The very gently rolling terrain slopes slightly downward from southwest to northeast. The highest point is approximately 394.7 meters (1295 feet) above mean sea level. The field is roughly L-shaped with an area of approximately 0.38 square kilometers (0.14 square miles); it is 1015 meters (3330 feet) long and 362.7 meters (1190 feet) wide. Approach azimuths are 105° and 285°. Hard surface roads on two sides of the field and dirt roads on the other two allow easy access to the field.

1. ROADS

ROUTE NUMBER/NAME	ROUTE LOCATION (GRID REFERENCE)		LENGTH OF SEGMENT		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS
	FROM	TO	km	(mi)			CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	
Adams Hill Road											
Segment a	594331	597339	0.9	(0.6)	No data	All weather	Asphalt	6.7 (22)/fair	No shoulder		
Segment b	597339	588343	1.0	(0.6)	No data	All weather	Asphalt	6.7 (22)/good	No shoulder		
Apache Gate Road	546378	546414	3.5	(2.2)	50	All weather	Asphalt	6.7 (22)/good	Gravel	1.8 (6)/good	
Arbuckle Hill Road	619329	620335	0.6	(0.4)	No data	Fair weather	Gravel	4.9 (16)/good	No shoulder		
Artillery Ridge Road	526374	507383	2.3	(1.4)	No data	All weather	Asphalt	7.9 (26)/good	Gravel	0.6 (2)/fair	
Austin Ridge Road											
Segment a	636390	654374	2.5	(1.6)	No data	Fair weather	Improved dirt	12.2 (40)/no data	No data		
Segment b	654374	655374	0.1	(0.1)	No data	Fair weather	Improved dirt	6.1 (20)/fair	No data		
Segment c	655374	657373	0.2	(0.1)	No data	Fair weather	Gravel	7.3 (24)/good	No shoulder		
Bald Ridge Road	575366	657398	9.7	(6.0)	No data	All weather	Asphalt	6.1 (20)/fair	No shoulder		
Barbour Road											
Segment a	534364	537365	0.3	(0.2)	No data	All weather	Asphalt	9.1 (30)/good	No shoulder		Curb and gutter.
Segment b	537365	538367	0.2	(0.1)	No data	All weather	Asphalt	7.9 (26)/good	Gravel	1.8 (6)/good	
Bateman Road	540374	546378	0.8	(0.5)	No data	All weather	Asphalt	6.7 (22)/good	Gravel	1.2 (4)/fair	
Beef Creek Road											
Segment a	575364	577387	2.3	(1.4)	16	All weather	Asphalt	7.3 (24)/good	Gravel	1.8 (6)/good	Road narrows at Hoyle Bridge.
Segment b	577387	585392	0.9	(0.6)	No data	All weather	Asphalt	7.9 (26)/good	No shoulder		
Segment c	585392	600432	4.6	(2.8)	No data	Fair weather	Gravel	7.3 (24)/good	No shoulder		
Blue Beaver Valley Road											
Segment a	417328	417344	1.6	(1.0)	No data	All weather	Asphalt	6.1 (20)/good	No shoulder		
Segment b	417344	417373	3.2	(2.0)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	1.2 (4)/fair	
Segment c	417373	364417	7.4	(4.6)	No data	All weather	Asphalt	6.7 (22)/fair	Gravel	0.9 (3)/poor	
Brown Hill Road											
Segment a	415367	414368	0.2	(0.1)	No data	Fair weather	Improved dirt	6.1 (20)/fair	No shoulder		
Segment b	414368	401366	1.4	(0.9)	No data	Fair weather	Improved dirt	12.2 (40)/fair	No shoulder		
Segment c	401366	390370	1.3	(0.8)	No data	Fair weather	Improved dirt	9.8 (32)/poor	No shoulder		
Brush Canyon Road											
Segment a	473375	482403	3.4	(2.1)	No data	Fair weather	Improved dirt	12.2 (40)/poor	No data		Within impact area.
Segment b	482403	484409	0.6	(0.4)	No data	Fair weather	Improved dirt	3.7 (12)/poor	No data		
Burrill Road											
Segment a	553359	555363	0.5	(0.3)	No data	All weather	Asphalt	8.2 (27)/good	No shoulder		Curb and gutter.
Segment b	555363	556366	0.3	(0.2)	No data	All weather	Asphalt	9.1 (30)/good	No shoulder		Curb and gutter.
Cache Creek Road											
Segment a	586335	588343	0.9	(0.6)	No data	Fair weather	Gravel	9.1 (30)/good	No shoulder		
Segment b	588343	584358	1.6	(1.0)	No data	All weather	Asphalt	7.3 (24)/fair	No shoulder		
Segment c	584358	575365	1.3	(0.8)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	0.9 (3)/fair	
Chatto Road	539385	546384	0.8	(0.5)	No data	Fair weather	Gravel	4.9 (16)/fair	No shoulder		
Condon Road											
Segment a	552343	551348	0.6	(0.4)	No data	All weather	Asphalt	10.1 (33)/good	No shoulder		Curb and gutter.
Segment b	551348	551354	0.6	(0.4)	No data	All weather	Asphalt	7.9 (26)/good	Asphalt	1.2 (4)/good	
Segment c	551354	553359	0.5	(0.3)	No data	All weather	Asphalt	9.1 (30)/good	No shoulder		Curb and gutter.

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

ROUTE NUMBER/NAME	ROUTE LOCATION (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT km (mi)		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS	
							CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)		
Craig Road												
Segment a	540361	543366	0.5	(0.3)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	2.4 (8)/good	Curb and gutter.	
Segment b	543366	543368	0.2	(0.1)	No data	All weather	Asphalt	7.9 (26)/good	No shoulder			
Segment c	543368	543369	0.1	(0.1)	No data	All weather	Asphalt	7.9 (26)/good	No shoulder			
Craterville Road	337363	360361	2.4	(1.5)	100	All weather	Asphalt	7.9 (26)/good	No shoulder		Road narrows at bridge over Crater Creek.	
Currie Road												
Segment a	535362	534364	0.2	(0.1)	No data	All weather	Asphalt	8.2 (27)/good	Asphalt	2.4 to 3 (8 to 10)/good		
Segment b	534364	534366	0.2	(0.1)	No data	All weather	Asphalt	8.5 (28)/good	Asphalt	2.4 to 3 (8 to 10)/good		
Segment c	534366	538374	0.9	(0.6)	No data	All weather	Asphalt	7.6 (25)/good	Asphalt	2.4 to 3 (8 to 10)/good		
Dale Road	522344	522345	0.1	(0.1)	No data	All weather	Asphalt	7.6 (25)/good	No shoulder			
Deer Creek Canyon Road	398413	464417	7.7	(4.8)	No data	All weather	Asphalt	8.2 (27)/good	No shoulder			
Dodge Hill Road	575392	609389	3.4	(2.1)	40	All weather	Asphalt	6.7 (22)/fair	No shoulder			
East Boundary Road	654329	641473	16.6	(10.3)	No data	All weather	Asphalt	6.1 (20)/fair	No shoulder			
Elgin Road	563381	641473	12.6	(7.8)	50	All weather	Asphalt	6.7 (22)/good	Gravel	0.6 (2)/fair		
Elgin Tank Road	642473	655454	4.2	(2.6)	No data	Fair weather	Improved dirt	10.7 (35)/no data	No data			
Fort Sill Boulevard												
Segment a	546329	546355	2.7	(1.7)	No data	All weather	Asphalt	7.3 (24)/good	Asphalt	2.7 (9)/fair		
Segment b	546355	546360	0.5	(0.3)	No data	All weather	Asphalt	11.0 (36)/good	Asphalt	1.2 to 2.7 (4 to 9)/good		
Segment c	546360	547365	0.5	(0.3)	No data	All weather	Asphalt	7.3 (24)/good	Asphalt	1.8 (6)/good		
Segment d	547365	547367	0.1	(0.1)	No data	All weather	Asphalt	10.4 (34)/good	Asphalt	1.8 (6)/good		
Segment e	547367	547368	0.1	(0.1)	No data	All weather	Asphalt	9.4 (31)/good	Asphalt	0 to 1.2 (0 to 4)/good		
Frisco Ridge Road	610443	600450	1.3	(0.8)	No data	Fair weather	Gravel	7.3 (24)/good	No shoulder			
Geronimo Road	558358	560360	0.3	(0.2)	No data	All weather	Asphalt	8.2 (27)/good	Asphalt	0.6 (2)/good		
Gruber Hill Road												
Segment a	443328	443344	1.6	(1.0)	No data	Fair weather	Gravel	6.1 (20)/good	No shoulder		Within impact area.	
Segment b	433344	417370	4.1	(2.5)	No data	Fair weather	Improved dirt	12.2 (40)/poor	No shoulder			
Segment c	417373	417410	3.8	(2.4)	No data	Fair weather	Improved dirt	12.2 (40)/poor	No shoulder			
Hanson Road (Road 20)	517355	522375	2.8	(1.7)	No data	All weather	Asphalt	7.3 (24)/good	No shoulder			
Hartell Boulevard												
Segment a	529343	531343	0.1	(0.1)	No data	All weather	Asphalt	10.7 (35)/good	Asphalt	0.9 to 2.4 (3 to 8)/good		
Segment b	531343	538341	0.8	(0.5)	No data	All weather	Asphalt	6.7 (22)/good	Asphalt	2.4 (8)/good		
Segment c	538341	544340	0.5	(0.3)	No data	All weather	Asphalt	6.7 (22)/good	Asphalt	3 (10)/good		
Segment d	544340	546340	0.3	(0.2)	No data	All weather	Asphalt	10.4 (34)/good	Asphalt	1.2 (4)/good		
H.E. Bailey Turnpike	593457	618473	2.9	(1.8)	No data	All weather	Asphalt	14.6 (48)/excellent	Asphalt	3.7 (12)/good	Divided highway, grass median, each lane 7.3 m (12 ft).	
Indian Hill Road	526374	508394	3.7	(2.3)	No data	Fair weather	Gravel	7.9 (26)/good	No shoulder			
Ketch Road												
Segment a	398396	396401	0.6	(0.4)	No data	All weather	Asphalt	6.7 (22)/fair	Gravel	0.9 (3)/poor		
Segment b	396401	398412	1.2	(0.7)	No data	All weather	Asphalt	7.3 (24)/fair	No shoulder			
Segment c	398412	399424	1.3	(0.8)	No data	Fair weather	Improved dirt	3.7 (12)/poor	No shoulder			
Lake George Road												
Segment a	606329	606332	1.2	(0.7)	No data	Fair weather	Improved dirt	6.1 (20)/good	No shoulder			
Segment b	606332	597339	0.3	(0.2)	No data	Fair weather	Gravel	4.6 (15)/poor	No shoulder			
Macomb Road												
Segment a	538367	543366	0.4	(0.2)	No data	All weather	Asphalt	9.8 (32)/good	No shoulder		Curb and gutter.	
Segment b	543366	547365	0.4	(0.2)	No data	All weather	Asphalt	13.4 (44)/good	No shoulder		Curb and gutter on one side of road.	
Segment c	547365	551364	0.5	(0.3)	No data	All weather	Asphalt	7.9 (26)/good	Asphalt	2.7 (9)/good		
Segment d	551364	560360	1.0	(0.6)	No data	All weather	Asphalt	7.6 (25)/good	Asphalt	2.4 (8)/good		
March Ridge Road	465416	476398	7.9	(4.9)	No data	Fair weather	Improved dirt	14.6 (48)/no data	No shoulder			
MB-4 Road												
Segment a	535372	535375	0.3	(0.2)	No data	Fair weather	Gravel	4.9 (16)/fair	No shoulder			
Segment b	535375	527385	1.4	(0.9)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder			
McKenzie Hill Road												
Segment a	322344	357344	3.9	(2.4)	No data	All weather	Asphalt	7.3 (24)/fair	No shoulder		Metal gates on either side of State Highway 115.	
Segment b	357344	417344	6.0	(3.7)	No data	All weather	Asphalt	6.7 (22)/fair	No shoulder			
Segment c	417344	499345	8.5	(5.3)	No data	All weather	Asphalt	7.9 (26)/good	Gravel	0.6 (2)/good		
Segment d	499345	507345	0.8	(0.5)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	1.8 (6)/good		
Segment e	507345	521343	1.4	(0.9)	No data	All weather	Asphalt	6.7 (22)/good	Gravel	0.9 (3)/good		
Segment f	521343	522344	0.2	(0.1)	No data	All weather	Asphalt	6.4 (21)/good	No shoulder			
Miner Road												
Segment a	507356	521354	1.4	(0.9)	No data	All weather	Asphalt	6.7 (22)/good	Gravel	0.6 (2)/good		
Segment b	521354	526353	0.5	(0.3)	No data	All weather	Asphalt	7.3 (24)/good	No shoulder			
Segment c	526353	531352	0.5	(0.3)	No data	All weather	Asphalt	10.1 (33)/good	Asphalt	2.1 (7)/good		Shoulder on one side of road.

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

ROUTE NUMBER/NAME	ROUTE LOCATION (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT km (mi)		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS
							CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	
Mission Road	256328	258360	3.4	(2.1)	No data	Fair weather	Improved dirt	6.1 (20)/poor	No shoulder		Part within impact area.
Moway Road	498329	498345	1.6	(1.0)	No data	All weather	Asphalt	7.3 (24)/good	No data		
Mount Hinds Road	479386	507383	3.4	(2.1)	No data	Fair weather	Improved dirt	12.2 (40)/poor	No data		Within impact area.
North Boundary Road											
Segment a	460422	464417	0.7	(0.4)	No data	Fair weather	Gravel	4.9 (16)/fair	No shoulder		
Segment b	464417	473414	1.0	(0.6)	No data	All weather	Asphalt	7.3 (24)/good	Dirt	2.4 (8)/fair	
Segment c	473414	500412	2.9	(1.8)	No data	All weather	Asphalt	7.3 (24)/good	No shoulder		
Segment d	500412	520412	2.1	(1.3)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	1.8 (6)/fair	
Segment e	520412	545408	2.7	(1.7)	No data	All weather	Asphalt	6.1 (20)/fair	Gravel	1.8 (6)/fair	
North Field Road											
Segment a	575378	572380	0.5	(0.3)	No data	All weather	Asphalt	7.3 (24)/good	No shoulder		
Segment b	572380	569386	0.7	(0.4)	No data	All weather	Asphalt	5.5 (18)/good	No shoulder		
Segment c	570387	570401	1.4	(0.9)	No data	Fair weather	Gravel	4.9 (16)/fair	No shoulder		
Segment d	570401	577399	0.8	(0.5)	No data	Fair weather	Improved dirt	9.1 (30)/poor	No shoulder		
Old Star Road											
Segment a	241384	317376	8.3	(5.2)	No data	Fair weather	Improved dirt	18.3 (60)/poor	No shoulder		
Segment b	317376	317371	0.4	(0.2)	No data	Fair weather	Gravel	6.1 (20)/good	No shoulder		
Segment c	322344	317371	3.1	(1.9)	No data	Fair weather	Gravel	7.3 (24)/good	No shoulder		
Parks Hill Road											
Segment a	607329	608330	0.2	(0.1)	No data	Fair weather	Gravel	6.1 (20)/good	No data		
Segment b	608330	609335	0.5	(0.3)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No data		
Pecan Grove Road	364344	361373	4.7	(2.9)	No data	Fair weather	Gravel	6.1 (20)/fair	No shoulder		
Pecan Valley Road											
Segment a	362352	373352	1.2	(0.7)	No data	Fair weather	Improved dirt	9.1 (30)/poor	No shoulder		
Segment b	373352	374344	0.8	(0.5)	No data	Fair weather	Unimproved dirt	3.7 (12)/fair	No shoulder		
Post Road											
Segment a	552343	558337	0.8	(0.5)	No data	All weather	Asphalt	10.1 (33)/good	No shoulder		Curb and gutter.
Segment b	558337	561335	0.4	(0.2)	No data	All weather	Asphalt	10.1 (33)/good	Asphalt	0.9 (3)/good	
Punch Bowl Road											
Segment a	506409	539385	4.3	(2.7)	No data	All weather	Asphalt	7.3 (24)/fair	Gravel	1.8 (6)/fair	
Segment b	539385	546379	0.9	(0.6)	No data	All weather	Asphalt	6.1 (20)/fair	No shoulder		
Quannah Tower Road											
Segment a	357344	357347	0.3	(0.2)	No data	Fair weather	Improved dirt	6.1 (20)/good	No shoulder		
Segment b	357347	353346	0.7	(0.4)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		
Quinett Road											
Segment a	551365	552367	0.3	(0.2)	No data	All weather	Asphalt	7.6 (25)/good	No shoulder		Curb.
Segment b	552367	553370	0.3	(0.2)	No data	All weather	Asphalt	7.6 (25)/good	Asphalt	0 to 2.4 (0 to 8)/good	
Segment c	553370	554372	0.2	(0.1)	No data	All weather	Asphalt	7.0 (23)/good	No shoulder		Curb and gutter.
Segment d	554372	556374	0.4	(0.2)	No data	All weather	Asphalt	6.7 (22)/good	No shoulder		
Segment e	556374	563381	1.0	(0.6)	No data	All weather	Asphalt	6.4 (21)/good	Gravel	1.8 (6)/good	U.S. Highway 62 overpass restricts road to 12.1 m (40 ft) horizontal clearance, 5 m (16.5 ft) vertical clearance.
Randolph Road											
Segment a	526374	531372	0.5	(0.3)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	0.9 (3)/good	
Segment b	531372	535370	0.5	(0.3)	No data	All weather	Asphalt	7.3 (24)/good	Asphalt	1.8 (6)/fair	
Segment c	535370	537369	0.2	(0.1)	No data	All weather	Asphalt	7.3 (24)/good	Asphalt	1.2 to 3 (4 to 10)/good	
Segment d	537369	539369	0.2	(0.1)	No data	All weather	Asphalt	8.2 (27)/good	No shoulder		Curb and gutter.
Segment e	539369	540369	0.1	(0.1)	No data	All weather	Asphalt	6.7 (22)/good	No shoulder		Curb and gutter.
Segment f	540369	547368	0.7	(0.4)	No data	All weather	Asphalt	9.1 (30)/good	No shoulder		Curb and gutter.
Segment g	547368	556366	0.9	(0.6)	No data	All weather	Asphalt	9.1 (30)/good	Asphalt	2.4 (8)/good	Shoulder on one side of road, curb and gutter on the other side.
Rocky Twins Road											
Segment a	480414	504402	2.8	(1.7)	No data	Fair weather	Gravel	9.1 (30)/good	No shoulder		
Segment b	504402	515398	1.3	(0.8)	No data	Fair weather	Improved dirt	7.6 (25)/poor	No shoulder		
Sheridan Road											
Segment a	530329	530331	0.3	(0.2)	No data	All weather	Asphalt	13.4 (44)/good	Asphalt	3.4 to 3.7 (11 to 12)/good	Shoulder width varies on each side of roadway.
Segment b	530331	529343	1.1	(0.7)	No data	All weather	Asphalt	10.1 (33)/good	Asphalt	3 (10)/good	
Segment c	529343	529344	0.2	(0.1)	No data	All weather	Asphalt	13.4 (44)/good	Asphalt	3 (10)/good	
Segment d	529344	531352	0.9	(0.6)	No data	All weather	Asphalt	6.7 (22)/good	Asphalt	3.7 to 4.9 (12 to 16)/good	Shoulder width varies on each side of roadway.
Segment e	531352	533360	0.8	(0.5)	No data	All weather	Asphalt	6.7 (22)/good	Asphalt	3.7 (12)/good	
Segment f	533360	535362	0.3	(0.2)	No data	All weather	Asphalt	10.4 (34)/good	Asphalt	3.7 (12)/good	Shoulder on one side of road.
Segment g	535362	540361	0.5	(0.3)	No data	All weather	Asphalt	6.7 (22)/good	Asphalt	3.7 (12)/good	
Segment h	540361	563356	2.4	(1.5)	No data	All weather	Asphalt	6.7 (22)/good	Asphalt	3 (10)/good	
Segment i	563356	565355	0.2	(0.1)	No data	All weather	Asphalt	14.6 (48)/good	Asphalt	1.2 (4)/good	

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

ROUTE NUMBER/NAME	ROUTE LOCATION (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT km (mi)		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS
							CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	
Segment j	565355	567353	0.2	(0.1)	No data	All weather	Asphalt	15.2 (50)/good	No shoulder		U.S. Highway 62 overpass restricts westbound lane to 7.3 m (24 ft) and eastbound lane to 7.9 m (26 ft); 4.7 m (15.6 ft) vertical clearance. Curb and gutter next to median.
Segment k	567353	567353	0.06	(0.04)	No data	All weather	Asphalt	14.6 (48)/good	Asphalt	2.1 to 4.0 (7 to 13)/good	7.3-m (24-ft) lanes divided by median. Curb and gutter next to median; shoulder width varies on each side of roadway.
Segment l	567353	568353	0.06	(0.04)	No data	All weather	Asphalt	12.5 (41)/good	Asphalt	1.2 to 3.4 (4 to 11)/good	Shoulder width varies on each side of roadway.
Signal Mountain Road											
Segment a	401392	417392	1.6	(1.0)	No data	Fair weather	Gravel	6.1 (20)/fair	Dirt	4.9 (16)/fair	Bridge out over Blue Beaver Creek, road at Blue Beaver Creek blocked with piles driven into road, part within impact area.
Segment b	417392	478373	6.6	(4.1)	No data	Fair weather	Improved dirt	9.1 (30)/poor	No shoulder		
Segment c	478373	502365	2.6	(1.6)	No data	Fair weather	Improved dirt	12.2 (40)/poor	No shoulder		
Segment d	502365	507366	0.5	(0.3)	No data	Fair weather	Improved dirt	6.1 (20)/poor	No shoulder		
Snow Ridge Road											
Segment a	529393	529394	0.2	(0.1)	No data	Fair weather	Gravel	7.3 (24)/fair	No shoulder		
Segment b	529394	531397	0.3	(0.2)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No shoulder		
Segment c	531397	546389	2.4	(1.5)	No data	Fair weather	Improved dirt	9.1 (30)/fair	No shoulder		
Segment d	546389	547389	0.1	(0.1)	No data	Fair weather	Gravel	4.9 (16)/fair	No shoulder		
South Boundary Road											
Segment a	225328	322344	10.6	(6.6)	No data	All weather	Asphalt	7.3 (24)/fair	Gravel	1.8 (6)/fair	
Segment b	353328	417328	6.4	(4.0)	No data	Fair weather	Improved dirt	7.9 (26)/fair	No shoulder		
Segment c	417328	530329	11.3	(7.0)	No data	All weather	Asphalt	7.3 (24)/good	No shoulder		
Segment d	567353	586335	3.1	(1.9)	No data	All weather	Asphalt	6.7 (22)/good	No shoulder		
Segment e	586335	654329	7.2	(4.5)	No data	All weather	Asphalt	6.1 (20)/fair	Gravel	0.6 (2)/fair	
State Highway 115	337336	336376	4.0	(2.5)	No data	All weather	Asphalt	7.3 (24)/good	No shoulder		
Tower Two Road	507345	500411	6.9	(4.3)	No data	All weather	Asphalt	7.3 (24)/good	Gravel	2.4 (8)/fair	
Upton Road	538374	540374	0.2	(0.1)	No data	All weather	Asphalt	7.9 (26)/good	Asphalt	1.2 (4)/good	Shoulder on one side of road, curb and gutter on one side of road.
U.S. Highways 62, 277, 281	562337	553410	7.6	(4.7)	No data	All weather	Asphalt	14.6 (48)/excellent	Asphalt	2.4 (8)/good	Joint right-of-way; divided highway, grass median, each lane 7.3 m (24 ft).
West Boundary Road											
Segment a	225328	224360	3.1	(1.9)	No data	All weather	Asphalt	6.1 (20)/fair	No shoulder		
Segment b	224360	224392	3.2	(2.0)	No data	Fair weather	Improved dirt	18.3 (60)/poor	No shoulder		Traveled path is typically 4.6 to 9.1 m (15 to 30 ft).
West Lake Road											
Segment a	466329	465347	1.9	(1.2)	No data	Fair weather	Gravel	6.1 (20)/fair	No shoulder		Part within impact area.
Segment b	465347	465377	3.6	(2.2)	No data	Fair weather	Improved dirt	12.2 (40)/poor	No shoulder		Within impact area.
Wilson Street											
Segment a	522345	524345	0.3	(0.2)	No data	All weather	Asphalt	10.1 (33)/good	No shoulder		
Segment b	524345	530344	0.5	(0.3)	No data	All weather	Asphalt	10.1 (33)/good	No shoulder		Curb and gutter.
Road 9	577399	578412	1.8	(1.1)	No data	Fair weather	Gravel	4.9 (16)/good	No shoulder		
Road 11	574364	566382	2.2	(1.4)	No data	Fair weather	Gravel	3.7 (12)/good	No shoulder		
Road 15	537374	537377	0.3	(0.2)	No data	Fair weather	Gravel	3.7 (12)/good	No shoulder		
Road 17											
Segment a	523389	522392	0.2	(0.1)	No data	Fair weather	Gravel	6.1 (20)/no data	No data		
Segment b	522392	519392	0.6	(0.4)	No data	Fair weather	Gravel	3.7 (12)/no data	No data		
Road 18	515392	516400	0.8	(0.5)	No data	Fair weather	Improved dirt	7.6 (25)/poor	No shoulder		
Road 19	507394	506397	0.7	(0.4)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No data		
Road 21	507366	513365	0.5	(0.3)	No data	All weather	Asphalt	8.5 (28)/fair	No shoulder		
Road 22	498345	507350	1.5	(0.9)	No data	Fair weather	Gravel	7.3 (24)/fair	No shoulder		
Road 23											
Segment a	498345	494349	0.6	(0.4)	No data	All weather	Asphalt	6.1 (20)/fair	No data		Part within impact area.
Segment b	494349	488346	0.8	(0.5)	No data	Fair weather	Gravel	4.9 (16)/fair	No data		Within impact area.
Road 24											
Segment a	479342	488346	1.0	(0.6)	No data	Fair weather	Improved dirt	4.9 (16)/fair	No data		
Segment b	488346	494349	0.7	(0.4)	No data	Fair weather	Gravel	4.9 (16)/fair	No data		Within impact area.
Road 25	482329	482342	1.3	(0.8)	No data	Fair weather	Gravel	6.1 (20)/good	No shoulder		
Road 26	449329	449344	1.5	(0.9)	No data	Fair weather	Gravel	6.1 (20)/good	No shoulder		
Road 28	438421	446424	1.5	(0.9)	No data	All weather	Asphalt	6.7 (22)/good	No shoulder		
Road 29	431413	430419	0.6	(0.4)	No data	Fair weather	Gravel	4.6 (15)/fair	No shoulder		
Road 30											
Segment a	398397	392401	0.7	(0.4)	No data	Fair weather	Gravel	4.6 (15)/fair	No shoulder		
Segment b	392401	390402	0.2	(0.1)	No data	Fair weather	Improved dirt	2.1 (7)/fair	No shoulder		
Road 31	375403	375409	0.9	(0.6)	No data	Fair weather	Improved dirt	3.7 (12)/fair	No shoulder		

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

ROUTE NUMBER/NAME	ROUTE LOCATION (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT km (mi)		MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDER		REMARKS
							CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	CONSTRUCTION MATERIALS	WIDTH/CONDITION m (ft)	
Road 32	379404	373402	0.5	(0.3)	No data	Fair weather	Gravel	4.6 (15)/good	No shoulder		
Road 33	365405	367415	1.2	(0.7)	No data	Fair weather	Improved dirt	3.7 (12)/no data	No data		
Road 34	407359	404366	0.8	(0.5)	No data	Fair weather	Improved dirt	3.7 (12)/no data	No data		
Road 36	406358	413356	1.0	(0.6)	No data	Fair weather	Improved dirt	4.9 (16)/no data	No data		
Road 37	410345	412353	1.0	(0.6)	No data	Fair weather	Improved dirt	3.7 (12)/no data	No data		
Road 38	407344	395360	2.6	(1.6)	No data	Fair weather	Improved dirt	7.3 (24)/no data	No data		
Road 39	409330	410344	1.5	(0.9)	No data	Fair weather	Improved dirt	7.3 (24)/no data	No data		
Road 40	386328	385344	1.5	(0.9)	No data	Fair weather	Improved dirt	7.6 (25)/fair	No data		
Road 42											
Segment a	337350	345356	1.4	(0.9)	No data	Fair weather	Improved dirt	4.6 (15)/no data	No data		
Segment b	345356	347357	0.2	(0.1)	No data	All weather	Asphalt	3.7 (12)/fair	No shoulder		
Segment c	347357	348361	0.4	(0.2)	No data	All weather	Asphalt	6.1 (20)/poor	No shoulder		
Road 43											
Segment a	272344	279344	0.6	(0.4)	No data	Fair weather	Improved dirt	4.6 (15)/fair	No shoulder		Within impact area.
Segment b	279344	288344	1.0	(0.6)	No data	Fair weather	Improved dirt	6.1 (20)/fair	No shoulder		Within impact area.
Segment c	288344	320344	3.2	(2.0)	No data	Fair weather	Improved dirt	7.3 (24)/poor	No shoulder		Traveled path typically 4.6 m (15 ft), road narrows at bridge over West Cache Creek; part within impact area.
Road 44											
Segment a	288360	315360	2.6	(1.6)	No data	Fair weather	Improved dirt	10.7 (35)/fair	No shoulder		Within impact area; grass covers much of road.
Segment b	315360	319360	0.4	(0.2)	No data	Fair weather	Improved dirt	4.6 (15)/fair	No shoulder		
Segment c	320360	336360	1.6	(1.0)	No data	Fair weather	Improved dirt	4.6 (15)/fair	No shoulder		
Unnamed Paved Roads			7.4	(4.6)							
Unnamed Gravel Roads			28.4	(17.6)							
Unnamed Improved Dirt Roads			352.7	(219.2)							
Unnamed Unimproved Dirt Roads			25.7	(16.0)							

ROAD BRIDGES

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION	DIMENSIONS	CLEARANCE	TYPE/ CONSTRUCTION MATERIALS	CONDITION	REMARKS
1	Craterville Road	343362	Crater Creek	One way : 100	7.5 m (24.8 ft) long 6.7 m (22 ft) wide Roadway width 5.5 m (18 ft)	Unlimited vertical 5.5 m (18 ft) horizontal	Concrete slab/concrete supports and deck	Fair	Posted weight limit 45 metric tons (50 short tons).
2	Road 43	316344	West Cache Creek	No data	36.6 m (120 ft) long 4.9 m (16 ft) wide Roadway width 4.3 m (14 ft)	Unlimited vertical 4.3 m (14 ft) horizontal	Concrete slab/concrete piers and deck	Fair	
3 (White Wolf Bridge)	Apache Gate Road	546379	Medicine Creek	One way : 100 Two way : 50	41.1 m (135 ft) long 10.3 m (33.7 ft) wide Roadway width 7.9 m (26 ft)	Unlimited vertical 9.8 m (32.2 ft) horizontal	Concrete slab/concrete pier, deck, and railings	Good	Posted weight limit 26 metric tons (29 short tons); concrete sidewalk along one side 1 m (3.3 ft) wide.
4 (Hoyle Bridge)	Beef Creek Road	575365	East Cache Creek	One way : 16	67.7 m (222 ft) long 5.8 m (19 ft) wide Roadway width 4.6 m (15 ft)	6.8 m (22.3 ft) vertical 4.6 m (15 ft) horizontal	Steel truss/steel I-beams with wood deck	Fair	Posted weight limit 7 metric tons (8 short tons).
5	Elgin Road	567384	East Cache Creek	Two way : 50	36.6 m (120 ft) long 8.2 m (27 ft) wide Roadway width 7.3 m (24 ft)	Unlimited vertical 7.3 m (24 ft) horizontal	Concrete slab/concrete pier with steel I-beam and concrete deck	Good	Posted weight limit 15 metric tons (17 short tons).
6	Dodge Hill Road	578392	Beef Creek	One way : 60 Two way : 40	21.3 m (70 ft) long 8.2 m (27 ft) wide Roadway width 7.3 m (24 ft)	Unlimited vertical 7.3 m (24 ft) horizontal	Concrete slab/concrete pier with steel I-beam and concrete deck	Good	Posted weight limit 15 metric tons (17 short tons).

2. RAILROADS

IDENTIFICATION NUMBER	SEGMENT OF TRACK (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT m (ft)	OWNERSHIP OF LINE AND CONDITION OF TRACK	TRACK AND BED CHARACTERISTICS	CROSSOVERS (GRID REFERENCE)	SIDINGS AND WYES (GRID REFERENCE)	VOLUME OF TRAFFIC	REMARKS
1				U.S. Government owned; excellent condition unless otherwise noted.	Single track, standard gage (1.44 m or 4 ft 8.5 in); minimum radius of curvature 122 m (400 ft); ballast material: rhyolite, andesite, and tuff; weight of rails at all road crossings: 44.6 kg/m (90 lb/yd), weight of rails of individual segments are listed separately.		Sidings are listed separately as segments.		All sidings are shown on the accompanying figure. Track connects at grid references 568357, 567355, and 563338 with the Chicago, Rock Island, and Pacific (CRI & P) Railroad which has a direct connection with the main line of the St. Louis-San Francisco (SL-SF) Railroad.
Segment a	561337	559337	237.7 (780)	Poor condition	Weight of rails: 44.6 kg/m (90 lb/yd)	No crossovers			Track condemned.
Segment b	563338	556340	771.1 (2530)	Poor condition	Weight of rails: 34.7 kg/m (70 lb/yd)	559338			Track condemned; 109.8-m (360-ft) length of track removed for U.S. Highways 62, 277, and 281 right-of-way.
Segment c	561337	560337	121.9 (400)	Poor condition	Weight of rails: 37.2 kg/m (75 lb/yd)	No crossovers			Track condemned.
Segment d	567355	565356	274.3 (900)		Weight of rails: 44.6 kg/m (90 lb/yd)	565356		300 or more car movements per month.	Branches off CRI & P Railroad; bridge underpass clearance unknown.
Segment e	568357	565356	243.8 (800)		Weight of rails: 44.6 kg/m (90 lb/yd)	No crossovers		300 or more car movements per month.	Branches off CRI & P Railroad; bridge underpass clearance unknown.
Segment f	565356	561359	545 (1790)		Weight of rails: 44.6 kg/m (90 lb/yd)	564357, 561359		5 to 24 car movements per month.	Siding to track segment 1h.
Segment g	561359	554363	759 (2490)		Weight of rails: 34.7 kg/m (70 lb/yd)	560360, 558360, 557362, 555363		5 to 24 car movements per month.	
Segment h	565356	560360	678.2 (2225)		Weight of rails: 39.7 kg/m (80 lb/yd)	564357, 561359		300 or more car movements per month.	

J. LINES OF COMMUNICATION (Continued)

2. RAILROADS (Continued)

IDENTIFICATION NUMBER	SEGMENT OF TRACK (GRID REFERENCE) FROM TO		LENGTH OF SEGMENT m (ft)	OWNERSHIP OF LINE AND CONDITION OF TRACK	TRACK AND BED CHARACTERISTICS	CROSSOVERS (GRID REFERENCE)	SIDINGS AND WYES (GRID REFERENCE)	VOLUME OF TRAFFIC	REMARKS
Segment i	560360	555363	528.8 (1735)		Weight of rails: 34.7 kg/m (70 lb/yd)	558360, 557362		300 or more car move-ments per month.	
Segment j	559360	557362	173.7 (570)		No data	558360		No data	
Segment k	554363	542366	1150.6 (3775)		Weight of rails: 39.7 kg/m (80 lb/yd)	551364, 547365, 547365, 542366		300 or more car move-ments per month.	
Segment l	544365	546365	190.5 (625)		Weight of rails: 34.7 kg/m (70 lb/yd)	No crossovers		Less than 5 car move-ments per month.	Siding to track segment 1n.
Segment m	546365	542366	429.8 (1410)		No data	542366		No data	Siding to track segment 1k.
Segment n	546365	543366	309.4 (1015)		Weight of rails: 37.2 kg/m (75 lb/yd)	No crossovers		300 or more car move-ments per month.	
Segment o	542366	539366	365.8 (1200)		Weight of rails: 39.7 kg/m (80 lb/yd)	No crossovers		25 to 99 car movements per month.	Siding to track segment 1k.
Segment p	542366	532363	1063.8 (3490)		Weight of rails: 37.2 kg/m (75 lb/yd)	541366, 536363, 535363		300 or more car move-ments per month.	
Segment q	532363	531363	106.7 (350)		Weight of rails: 37.2 kg/m (75 lb/yd)	532363		Less than 5 car move-ments per month.	
Segment r	536363	532363	451.1 (1480)		Weight of rails: 37.2 kg/m (75 lb/yd)	536363, 535363		100 to 299 car move-ments per month.	
Segment s	536364	532363	454.2 (1490)		Weight of rails: 37.2 kg/m (75 lb/yd)	536364, 535363		100 to 299 car move-ments per month.	
Segment t	537364	532363	391.7 (1285)		Weight of rails: 37.2 kg/m (75 lb/yd)	536364, 535364		100 to 299 car move-ments per month.	
Segment u	537364	534364	310.9 (1020)		Weight of rails: 37.2 kg/m (75 lb/yd)	536364, 535364		100 to 299 car move-ments per month.	
Segment v	538364	534364	378 (1240)		Weight of rails: 37.2 kg/m (75 lb/yd)	536364, 535364		100 to 299 car move-ments per month.	
Segment w	538364	534364	399.3 (1310)		Weight of rails: 37.2 kg/m (75 lb/yd)	536364, 535364		100 to 299 car move-ments per month.	
Segment x	539364	534365	437.4 (1435)		Weight of rails: 37.2 kg/m (75 lb/yd)	537365, 536365, 534365		5 to 24 car movements per month.	
Segment y	534365	530371	848.9 (2785)		Weight of rails: 39.7 kg/m (80 lb/yd)	532365, 531369		5 to 24 car movements per month.	
Segment z	531368	530371	295.7 (970)		Weight of rails: 34.7 kg/m (70 lb/yd)	531369		5 to 24 car movements per month.	Siding to track segment 1y.
Segment aa	536365	532365	402.3 (1320)		Weight of rails: 37.2 kg/m (75 lb/yd)	534365, 532365		5 to 24 car movements per month.	Siding to track segment 1x.
Segment bb	534364	526367	902.2 (2960)		Weight of rails: 39.7 kg/m (80 lb/yd)	532364, 532364 530364		5 to 24 car movements per month.	
Segment cc	532364	534364	207.3 (680)		Weight of rails: 39.7 kg/m (80 lb/yd)	532364		Less than 5 car move-ments per month.	
Segment dd	532364	528367	595 (1955)		Weight of rails: 39.7 kg/m (80 lb/yd)	532364, 532364		Less than 5 car move-ments per month.	
Segment ee	526367	514363	1499.6 (4920)		Weight of rails: 44.6 kg/m (90 lb/yd)	523368, 516367		Less than 5 car move-ments per month.	
Segment ff	517367	513366	509 (1670)		Weight of rails: 44.6 kg/m (90 lb/yd)	515367		Less than 5 car move-ments per month.	Siding to track segment 1ee.
2				Chicago, Rock Island, and Pacific Railroad; no data on condition of track.	Single track, standard gage (1.44 m or 4 ft 8.5 in); ballast material: rhyolite, andesite, and tuff.			No traffic	Railroad is in the process of being liquidated. Future usage of the track is uncertain.
Segment a	563337	561387	5184.7 (17,010)		Weight of rails: 42.2 kg/m (85 lb/yd)	563337, 567353, 568360, 563381	Three parallel sidings from 565345 to 567353.		Sidings are shown on the accom-panying figure.
Segment b	561387	557403	1609.3 (5280)		Weight of rails: 39.7 kg/m (80 lb/yd)	No crossovers			
3	563337 and 594427	569400 6344473	6675 (21,900) 6172 (20,250)	St. Louis-San Francisco Railroad; fair to good condition.	Single track, standard gage (1.44 m or 4 ft 8 in); ballast material: rhyolite, andesite, and tuff; weight of rails: 55.6 kg/m (112 lb/yd).	563337, 567353, 568360, 563381, 569400 599432, 609443, 634473	Three sidings from 565345 to 568353.	Two trains per day nor-mally with approximately 50 cars per train, but could be as many as 100 cars.	Sidings are shown on the accompany-ing figure. Only freight trains use this section of track. Direction of traffic is divided equally both east and west. Crosses reservation in two places.

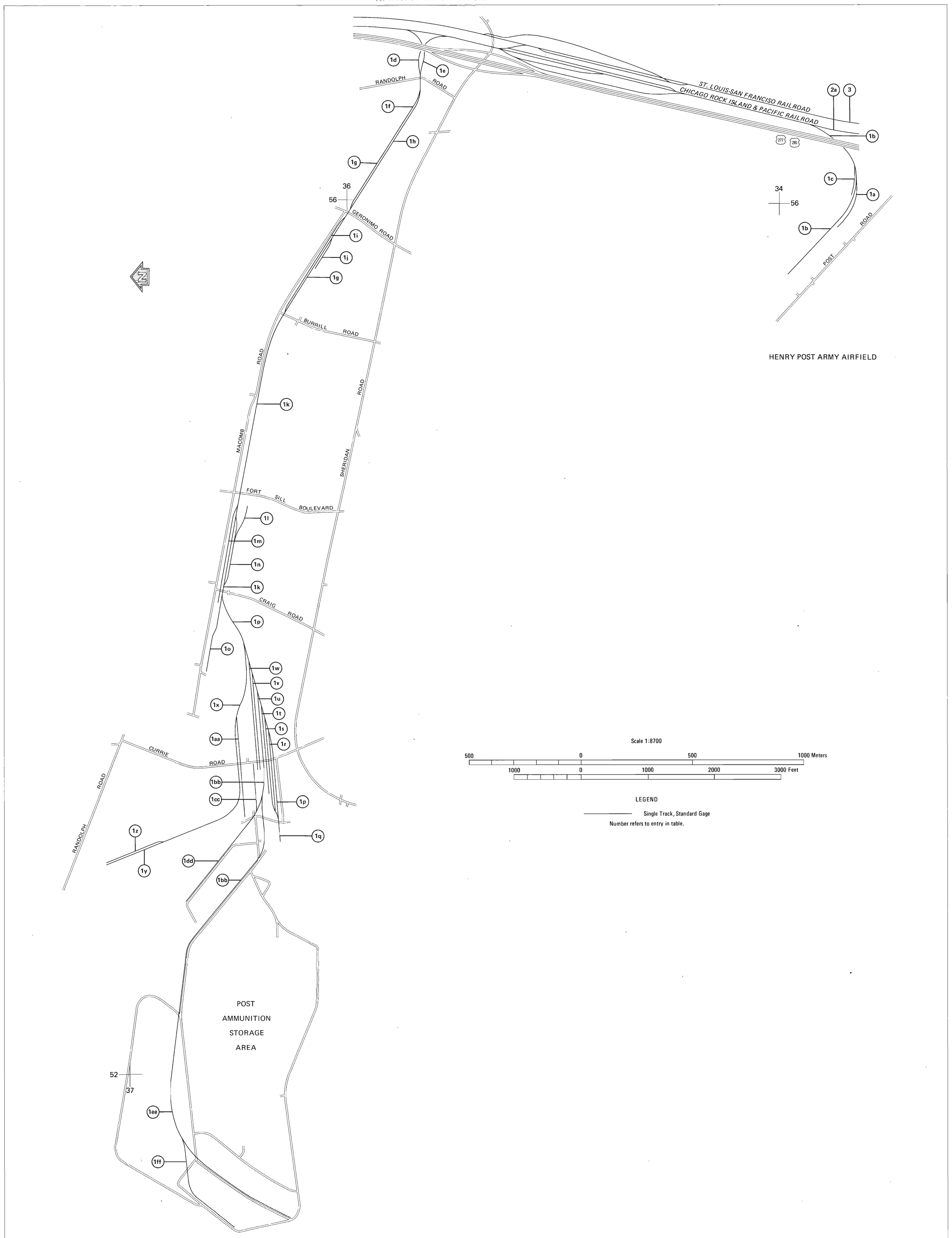
RAILROAD BRIDGES

IDENTIFICATION NUMBER	LOCATION (GRID REFERENCE)	FEATURE CROSSED	NUMBER OF TRACKS	ROADWAY WIDTH m (ft)	CLEARANCE		DECK MATERIAL	OVERALL LENGTH m (ft)	TYPE OF STRUCTURE	REMARKS
					HORIZONTAL	VERTICAL				
1 (4931)	565344	Sitting Bear Creek	One	6.1 (20)	Unlimited	Unlimited	No data	30.2 (99)	Eight-panel timber pile trestle.	Belongs to Chicago, Rock Island, and Pacific Railroad. Maximum bridge load rated at 119,297 kg (263,00 lb).
2 (4914)	566368	Medicine Creek	One	6.1 (20)	Unlimited	Unlimited	No data	51.8 (170)	Four-panel timber pile trestle; two 7.3-m (24-ft) steel I-beams, three 7.9-m (26-ft) steel I-beams.	Same as 1 above.
3 (4908)	564378	Intermittent tributary to East Cache Creek	One	6.1 (20)	Unlimited	Unlimited	No data	40.5 (133)	Ten-panel timber pile trestle.	Same as 1 above.
4 (4903)	561386	Intermittent tributary to East Cache Creek	One	6.1 (20)	Unlimited	Unlimited	No data	13.4 (44)	Four-panel timber pile trestle.	Same as 1 above.
5	565343	Sitting Bear Creek	One	7.3 (24)	No data	Unlimited	No data	32.3 (106)	No data	Belongs to St. Louis-San Francisco Railroad. Maximum bridge load rated at 119,297 kg (263,000 lb).
6	567368	Medicine Creek	One	7.3 (24)	No data	Unlimited	No data	55.8 (183)	No data	Same as 5 above.
7	564378	Intermittent tributary to East Cache Creek	One	7.3 (24)	No data	Unlimited	No data	35.4 (116)	No data	Same as 5 above.
8	562386	Intermittent tributary to East Cache Creek	One	7.3 (24)	No data	Unlimited	No data	105 (345)	No data	Same as 5 above.
9	564390	Unnamed gravel road	One	7.3 (24)	No data	Unlimited	No data	40.5 (133)	No data	Same as 5 above.
10	564392	East Cache Creek	One	7.3 (24)	No data	Unlimited	No data	78.3 (257)	No data	Same as 5 above.
11	566395	Tributary to East Cache Creek	One	7.3 (24)	No data	Unlimited	No data	93.6 (307)	No data	Same as 5 above.
12	623460	Intermittent stream	One	7.3 (24)	No data	Unlimited	No data	12.2 (40)	No data	Same as 5 above.

J. LINES OF COMMUNICATION (Continued)

2. RAILROADS (Continued)

RAILROAD SIDINGS ENLARGEMENT



J. LINES OF COMMUNICATION (Continued)

3. AIRFIELDS

MAP NUMBER AND NAME; LOCATION; CLASSIFICATION; AND TYPE	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
1. Henry Post Army Airfield; 551343; Army; Airfield.	362 m (1188 ft); operational.	<p>North-South Runway 17-35 1524 × 61 m (5000 × 200 ft); azimuth 172°-352°; maximum weight bearing capacity S100, T135, ST171, TT195*; concrete surface.</p> <p>Northwest-Southeast Runway 12-30 1123 × 46 m (3684 × 150 ft); azimuth 126°-306°; no data on maximum weight bearing capacity; sod surface.</p> <p>East-West Runway 08-26 610 × 46 m (2000 × 150 ft); azimuth 081°-261°; no data on maximum weight bearing capacity; sod surface.</p>	<p>Taxiways Four. Parallel and one connecting taxiway, 15.2 m (50 ft) wide; one connecting taxiway, 18.3 m (60 ft) wide; one connecting taxi- way, 30.5 m (100 ft) wide; weight bearing capacities same as the runway; concrete.</p> <p>Parking Apron and Hardstand 123,743 m² (1,332,000 ft²) ap- proximate total area; weight bearing capacities S22; portland cement concrete with double bituminous shoulders.</p>	<p>Hangars (include maintenance facilities) Building number 4908, also contains administrative space: concrete foundation, corrugated steel walls; approximate hangar area 3074 m² (36,314 ft²), ap- proximate height 12.2 m (40 ft). Building number 4915, also con- tains administrative space; con- crete and block; approximate hangar area 3133 m² (33,721 ft²), approximate height 13.7 m (45 ft), door height 9.8 m (32 ft). Building number 4920: concrete and block; approximate total area 6890 m² (22,606 ft²), approxi- mate height 13.7 m (45 ft), door height 9.8 m (32 ft). Building number 4922, also con- tains administrative and class- room space; concrete and block; approximate total floor space 3341 m² (35,966 ft²), approxi- mate height 9.1 m (30 ft). Building number 5037, balloon hangar (historic building): con- crete foundation, corrugated steel walls; approximate total area 2575.2 m² (27,720 ft²), ap- proximate height 24.4 m (80 ft).</p> <p>Maintenance Facilities (other than hangars) Building number 4912: concrete foundation, corrugated steel walls; approximate total area 37 m² (400 ft²).</p> <p>Administration and Terminal Buildings Building number 4907, airfield operations; concrete and block; 879.2 m² (9464 ft²). Within building number 4908 (see above): approximate office space 334.4 m² (3600 ft²). Within building number 4915 (see above): approximate office space 594.6 m² (6400 ft²). Within building number 4922 (see above): office space break- down not available.</p> <p>Other Buildings Building number 4919, flying club and parking shed: block and wood; 76.6 m² (825 ft²).</p>	<p>Tanks JP-4: two tanks, total capacity 257,380 L (68,000 gal). Aviation gasoline 100/130: one tank, 45,420 L (12,000 gal). Flying club has its own AvGas: one underground tank, approxi- mately 18,925 L (5000 gal).</p> <p>Trucks JP-4: four 7570-L (2000-gal) trucks; four 4542-L (1200-gal) trucks; two 18,925-L (5000-gal) tankers for fueling Chinooks. AvGas: two 7570-L (2000-gal) trucks.</p>	<p>Control Tower 18.3 m (60 ft) high. Scheduled weather broadcast; VHF omni- directional range (VOR); non- directional radio beacon (NBD); precision approach radar (PAR); approach surveillance radar (ASR). Instrument landing system (ILS) available at Lawton Munici- pal Airport (see Section III, Off- Post Features).</p> <p>Lights Rotating beacon; boundary lights; high intensity runway lights; high intensity approach lights.</p>	Approach and runway lights operate on request from tower; no aircraft starting unit (ASU); 9084-L (2400-gal) fuel limit at 189.2 Lpm (50 gpm); sod run- ways available for use by all fixed-wing aircraft when wind or runway conditions preclude safe use of the main runway, or during fixed-wing familiarization training missions; sod runways are unlighted.

*Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, and TT. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.
S = Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F100).
T = Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).
ST = Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130).
TT = Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135).

For further information, see DOD Flight Information Publication (enroute IFR-Supplement United States).

4. PIPELINES*

MAP NUMBER	GRID REFERENCE FROM TO	STATUS	OWNERSHIP	PIPELINE CHARACTERISTICS	TANK CROSSING SITES	REMARKS
1a	469416 499385	Operative	City of Lawton, OK	106.7-cm (42-in) diameter, con- crete and steel pipeline; 4.1 km (2.5 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 98 × 10 ⁶ Lpd (25.9 × 10 ⁶ gpd).†	No data	Sections of five underground pipelines within the same right- of-way; all carry drinking water to the City of Lawton and Fort Sill.
1b	469416 499385	Operative	City of Lawton, OK	76.2-cm (30-in) diameter, cast- iron pipe; 4.1 km (2.5 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 46.6 × 10 ⁶ Lpd (12.3 × 10 ⁶ gpd).	No data	
1c and d	469416 499385	Operative	City of Lawton, OK	Two 61-cm (24-in) diameter, cast- iron pipes; 4.1 km (2.5 mi) across the reservation; waterlines; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	
1e	469416 499385	Operative	City of Lawton, OK	40.1-cm (16-in) diameter, cast- iron pipe; 4.1 km (2.5 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	

J. LINES OF COMMUNICATION (Continued)

4. PIPELINES (Continued)

MAP NUMBER	GRID REFERENCE FROM TO		STATUS	OWNERSHIP	PIPELINE CHARACTERISTICS	TANK CROSSING SITES	REMARKS
2a	499385	515345	Operative	City of Lawton, OK	106.7-cm (42-in) diameter, concrete and steel pipe; 4.2 km (2.6 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 98 × 10 ⁶ Lpd (25.9 × 10 ⁶ gpd).	No data	Sections of four underground pipelines within the same right-of-way; connected at grid reference 499385 with pipes 1a, 1b, 1c, and 1e above; all carry drinking water to the City of Lawton and Fort Sill. Pumping station (grid reference 515345) rated at 11,352 Lpm (3000 gpm).†
2b	499385	515345	Operative	City of Lawton, OK	76.2-cm (30-in) diameter, cast-iron pipe; 4.2 km (2.6 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 46.6 × 10 ⁶ Lpd (12.3 × 10 ⁶ gpd).	No data	
2c	499385	515345	Operative	City of Lawton, OK	61-cm (24-in) diameter, cast-iron pipe; 4.2 km (2.6 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	
2d	499385	515345	Operative	City of Lawton, OK	40.1-cm (16-in) diameter, cast-iron pipe; 4.2 km (2.6 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	
3	499385	525373	Operative	City of Lawton, OK	61-cm (24-in) diameter, cast-iron pipe; 2.8 km (1.8 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	Underground pipeline connected at grid reference 499385 with pipe 1d above; carries drinking water to Fort Sill distribution system. Pumping station (grid reference 525373) rated at 15,138 Lpm (4000 gpm).
4a	515345	519335	Operative	City of Lawton, OK	76.2-cm (30-in) diameter, cast-iron pipe; 1.1 km (0.7 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 46.6 × 10 ⁶ Lpd (12.3 × 10 ⁶ gpd).	No data	Sections of three underground pipelines within the same right-of-way; connected at grid reference 515345 with pipes 2b, 2c, and 2d above; all carry drinking water to the City of Lawton.
4b	515345	519335	Operative	City of Lawton, OK	61-cm (24-in) diameter, cast-iron pipe; 1.1 km (0.7 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	
4c	515345	519335	Operative	City of Lawton, OK	35.6-cm (14-in) diameter, cast-iron pipe; 1.1 km (0.7 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	
5a	519335	524329	Operative	City of Lawton, OK	76.2-cm (30-in) diameter, cast-iron pipe; 0.8 km (0.5 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 46.6 × 10 ⁶ Lpd (12.3 × 10 ⁶ gpd).	No data	Sections of two underground pipelines within the same right-of-way; connected at grid reference 519335 with pipes 4a and b above; both carry drinking water to the City of Lawton.
5b	519335	524329	Operative	City of Lawton, OK	61-cm (24-in) diameter, cast-iron pipe; 0.8 km (0.5 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	
6	519335	522329	Operative	City of Lawton, OK	35.6-cm (14-in) diameter, cast-iron pipe; 0.7 km (0.4 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	Underground pipeline connected at grid reference 519335 with pipe 4c above.
7	515345	516329	Operative	City of Lawton, OK	106.7-cm (42-in) diameter, concrete and steel pipe; 1.7 km (1 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²), throughput 98 × 10 ⁶ Lpd (25.9 × 10 ⁶ gpd).	No data	Underground pipeline connected at grid reference 515345 with pipe 2a above.
8	516329	524329	Operative	City of Lawton, OK	91.4-cm (36-in) diameter, cast-iron pipe; 0.8 km (0.5 mi) across the reservation; waterline; burial depth 76.2 cm (30 in) to 1.8 m (6 ft); pressure 0.4 to 3.4 kg/cm ² (6 to 48 lb/in ²).	No data	Underground connector pipeline joining pipeline 7 above at grid reference 516329 with pipelines 6, 5a, and 5b above at grid references 521329, 524329, and 524329, respectively. Shares right-of-way with pipeline 13 below.
9	515345	526344	Operative	Fort Sill	40.1-cm (16-in) diameter, cast-iron pipe; 1.2 km (0.7 mi) across the reservation; waterline; burial depth 76.2 cm (30 in); no pressure data.	No data	Underground pipeline connected at grid reference 515345 with pipe 2c above; carries drinking water to Fort Sill distribution system.
10	557403	581333	Pre-operative (testing stage)	Waurika Lake Master Conservancy District	106.7-cm (42-in) diameter, concrete pipe; 7.7 km (4.8 mi) across the reservation; waterline; burial depth 1.2 to 1.8 m (4 to 6 ft); maximum throughput 94.6 × 10 ⁶ Lpd (25 × 10 ⁶ gpd).	No data	Underground pipeline; between grid reference 562386 and 567367 shares right-of-way with pipeline 11 below.
11	634473	564336	Operative	Arkansas-Louisiana Gas Company	Two 20.3-cm (8-in) diameter pipes; 16.3 km (10.2 mi) across the reservation; gaslines; burial depth 0.6 to 1.2 m (2 to 4 ft); pressure 14.1 to 21.1 kg/cm ² (200 to 300 lb/in ²).	No data	Two underground pipelines within the same 6.1 m (20 ft) right-of-way, paralleling the St. Louis-San Francisco Railroad; between grid reference 562386 and 567367 shares wider right-of-way with pipeline 10 above.
12	562385	558381	Operative	Arkansas-Louisiana Gas Company	10.2-cm (4-in) diameter pipe; 0.6 km (0.4 mi) across the reservation; gasline; burial depth 0.6 to 1.2 m (2 to 4 ft); pressure 7 kg/cm ² (100 lb/in ²).	No data	Underground pipeline branching off from pipeline 11 above at grid reference 562385.

J. LINES OF COMMUNICATION (Continued)

4. PIPELINES (Continued)

MAP NUMBER	GRID REFERENCE FROM TO		STATUS	OWNERSHIP	PIPELINE CHARACTERISTICS	TANK CROSSING SITES	REMARKS
13	498329	562329	Operative	Arkansas-Louisiana Gas Company	20.3-cm (8-in) diameter pipe; 6.3 km (3.9 mi) across the reservation; gasline; burial depth 0.6 to 1.2 m (2 to 4 ft); pressure 3.5 kg/cm ² (50 lb/in ²) in summer and 8.4 kg/cm ² (120 lb/in ²) in winter.	No data	Underground pipeline within a 6.1-m (20-ft) right-of-way, paralleling Rogers Lane; between grid reference 516329 and 524329 shares wider right-of-way with pipeline 8 above.
14a	656467	656462	Operative	Westheimer-Neustadt Corporation	5.1-cm (2-in) diameter, polyethylene pipe; 0.4 km (0.3 mi) across the reservation; gasline; burial depth 61 to 91.4 cm (24 to 36 in); pressure 1.4 to 1.8 kg/cm ² (20 to 25 lb/in ²).	No data	Underground pipeline from two active gas wells (grid references 656467 and 656462); saltwater from well at grid reference 656467 also goes through the line.
14b	656465	656465	Operative	Westheimer-Neustadt Corporation	5.1-cm (2-in) diameter, polyethylene pipe; 30.5 m (100 ft) across the reservation; gasline; burial depth 61 to 91.4 cm (24 to 36 in); pressure 1.4 to 1.8 kg/cm ² (20 to 25 lb/in ²).	No data	Underground pipeline collecting gas from gasline 14a above and transporting it off the reservation.

*Water distribution lines and sewerlines at Lake Elmer Thomas Recreation Area and Camp Eagle are not included.
†Lpd = liters per day; gpd = gallons per day; Lpm = liters per minute; gpm = gallons per minute.

5. HELICOPTER LANDING ZONES

MAP NUMBER AND/OR NAME	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION m (ft)	SURFACE MATERIAL	RESTRAINTS	REMARKS
1.	228390	4 pads each 13.7 × 13.7 m (45 × 45 ft)	No data	437.4 (1435)	Concrete	Pad size may cause difficulty in landing large helicopters.	Inactive; pads spaced approximately 68.6 m (225 ft) apart.
2. Post Oak	234371	Not applicable	0°-180°	438.9 (1440)	Grass	No restraints.	Windsock; inactive airstrip.
3.	248333	4 pads each 13.7 × 13.7 m (45 × 45 ft)	No data	402.3 (1320)	Concrete	Pad size may cause difficulty in landing large helicopters; trees to the south.	Inactive; pads spaced approximately 68.6 m (225 ft) apart; best approach is from the northeast.
4. Coyote	343347	Not applicable	No data	396.2 (1300)	Grass	Hill to the east; trees to the west.	Windsock; inactive airstrip.
5. Ketch Field	362411	609.6 × 12.2 m (2000 × 40 ft)	0°-180°	478.5 (1570)	Grass	Hill west of north end of field.	Windsock; inactive airstrip; gentle downslope north to south.
6. Gopher Field	389334	548.6 × 381 m (1800 × 1250 ft)	0°-180°	396.2 (1300)	Grass	Telephone line along southern edge of field.	Windsock; inactive airstrip.
7.	412335	335.3 × 82.2 m (1100 × 270 ft)	174°-354°	388.6 (1275)	Grass	Clump of trees at southwest corner of field.	Inactive airstrip.
8. Rabbit Hill	491418	762 × 304.8 m (2500 × 1000 ft)	0°-180°	390.1 (1280)	Grass	Telephone line along northern edge of field.	Windsock; inactive airstrip.
9.	538393	610 × 100 m (2000 × 330 ft)	129°-309°	356.6 (1170)	Grass	No restraints.	Inactive airstrip.
10. Ill Corps Artillery Headquarters	542371	12.8 × 12.8 m (42 × 42 ft)	No data	356.6 (1170)	Concrete	Buildings to the north, west, and south. Pad size may cause difficulty in landing large helicopters.	Windsock.
11. Snow Hall	558364	18.3 × 18.3 m (60 × 60 ft)	No data	353.6 (1160)	Hard surface	Buildings to west, northeast, and south. Automobile parking area adjacent to pad.	Windsock; landing pad in poor condition.
12. Weeks Dental Clinic	530357	12.8 × 12.8 m (42 × 42 ft)	No data	361.2 (1185)	Concrete	Buildings and powerline to the west. Pad size may cause difficulty in landing large helicopters.	Windsock.
13. Reynolds Army Hospital	540338	30.5 × 30.5 m (100 × 100 ft)	No data	359.7 (1180)	Hard surface	Buildings to the west and northwest.	Windsock; restricted to medical evacuation use only.
14. (Henry Post Army Airfield)	549346	15.8 × 15.8 m (52 × 52 ft)	172°-352°	362.1 (1188)	Concrete	No restraints.	Control tower; depending on time and condition, helicopters use the main runway or taxiway.
15. (Henry Post Army Airfield)	549341	15.8 × 15.8 m (52 × 52 ft)	172°-352°	362.1 (1188)	Concrete	No restraints.	Same as 14 above.
16. (Henry Post Army Airfield)	556343	48.8 × 48.8 m (160 × 160 ft)	Three approach and takeoff paths: 40°-220° 100°-280° 120°-300°	355.1 (1165)	Asphaltic concrete	Buildings to the south, water tower to the north.	Windsock.
17. (Henry Post Army Airfield)	558333	30.5 × 30.5 m (100 × 100 ft)	Three approach and takeoff paths: 134°, 225°, 312°	356.6 (1170)	Sod	No restraints.	Frequently used for instrumentation check-out during hovering, approaches, and landings.
18. Frisco Ridge	604451	Largest dimension 1066.8 × 624.8 m (3500 × 2050 ft)	4°-184°	400.5 (1314)	Grass	Telephone line approaching southwest corner of field.	Windsock; field is L-shaped; inactive airstrip.
19. Southeast Corner	652335	1015 × 362.7 m (3330 × 1190 ft)	105°-285°	394.7 (1295)	Grass	Reservation boundary fence along south edge of field.	Windsock; drop zone and inactive airstrip.

6. DROP ZONES

MAP NUMBER AND NAME	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION m (ft)	SURFACE DESCRIPTION	AIRCRAFT OBSTRUCTIONS	REMARKS
1. Southeast Corner Airfield	650329 652340 655339 653331 656330 656329	1015 × 362.7 m (3330 × 1190 ft)	105°-285°	394.7 (1295)	Grass covers entire area. Gently sloping downward from southwest to northeast.	None	Reservation boundary fence along southern edge of drop zone. Paved road access via East Boundary Road and West Boundary Road as well as dirt roads to the area.

K. URBAN AREA (CANTONMENT AREA)

TROOP BILLETS

TYPE	NUMBER OF BUILDINGS	CAPACITY	CONDITION†	REMARKS
Trainee				A large trainee complex has been constructed on the eastern side of the reservation. A 1100-man barracks is under construction in the same area; expected completion mid-1982.
Permanent	24	13,611 MN*	10 Good, 1 Fair, 13 Poor	Ten barracks are presently used to house reserve troops, a utilization of approximately 900 spaces.
Semipermanent	2	650	Poor	A number of buildings originally designated as BOQ are presently used as billets.
Temporary	143	9091	38 Good, 7 Fair, 98 Poor	Many of the buildings originally designated as barracks are presently used for administrative or supply functions.
Total	169	23,352	48 Good, 8 Fair, 113 Poor	
Permanent Party				
Permanent	40	18,357	Poor	
Semipermanent	4	1040	1 Good, 3 Poor	
Temporary	24	1294	Poor	
Total	68	20,691	1 Good, 67 Poor	

*MN = persons.

†Based on the condition code devised for the Integrated Facilities System Report and derived from a formula of 10 weighted inspection components. This formula yields C₁ — satisfactory = Good; C₂ — marginal (needs minor repairs, painting, etc.) = Fair; and C₃ — unsatisfactory (needs major work, painting, etc.) = Poor. A "Poor" building is not necessarily inadequate, but requires work which could bring it up to a better condition.

QUARTERS

TYPE	NUMBER OF BUILDINGS	CAPACITY	CURRENT LOAD†	YEAR OF CONSTRUCTION	CONDITION‡	REMARKS
Bachelor Officer Quarters (BOQ)						All BOQ are permanent structures.
Building number 1313	1	11 MN*	10 MN*	1915	Poor	Several buildings are garden apartment-type structures.
Buildings numbers 635, 1307	2	32	29	1934	Poor	
Buildings numbers 852, 853, 854, 5670, 5672, 5673, 5674	7	154	154	1963	1 Good, 6 Poor	
Buildings numbers 5676, 5685	2	300	264	1966	1 Fair, 1 Poor	Building number 5676 is six-story mid-rise.
Building number 5678	1	300	211	1967	Poor	Six-story mid-rise.
Total	13	797	668		1 Good, 1 Fair, 11 Poor	
Bachelor Enlisted Quarters (BEQ)						All BEQ are temporary and were originally designated as BOQ.
Buildings numbers 268, 4542, 4552	3	41	48	1941	1 Fair, 2 Poor	
Buildings numbers 2650, 2742, 2743, 2744, 2747, 2748, 2750, 2752, 2753, 5121	10	179	194	1942	Poor	
Building number 2749	1	17	22	1943	Poor	
Total	14	237	264		1 Fair, 13 Poor	
Guest Houses						
Cheyenne House	1	68		1941	Good	Cheyenne House, a converted BOQ, is the only permanent structure. The other four guest houses are converted World War II barracks.
Kiowa House	1	68		1942	Good	
Apache House	1	68		1942	Good	
Washita House	1	68		1941	Fair	
Caddo House	1	68		1941	Fair	
Total	5	340			3 Good, 2 Fair	

*MN = persons.

†Current load based on figures for April 1980.

‡Based on the condition code devised for the Integrated Facilities System Report and derived from a formula of 10 weighted inspection components. This formula yields C₁ — satisfactory = Good; C₂ — marginal (needs minor repairs, painting, etc.) = Fair; and C₃ — unsatisfactory (needs major work, painting, etc.) = Poor. A "Poor" building is not necessarily inadequate, but requires work which could bring it up to a better condition.

FAMILY HOUSING

TYPE	NUMBER OF BUILDINGS	NUMBER OF FAMILY UNITS	CURRENT LOAD*	YEAR OF CONSTRUCTION	CONDITION†	REMARKS
General	2 1 1	2 1 1	2 1 1	1870 1911 1934	Good Poor Poor	Two of the buildings are in the Old Post area (400 area).
Colonel	38 5 4	38 5 4	37 5 4	1934 1933 1911	Poor Poor Poor	There are some six-bedroom units along Upton Road. These are assigned to Colonels first, then to families of lesser rank with large households.
Lieutenant Colonel/ Major	9 14 7 9 38 32	18 32 7 9 92 40	17 31 7 9 90 39	1870 1911 1928 1933 1934 1963	4 Good, 5 Poor Poor Poor Poor Poor 25 Good, 7 Fair	Some houses along Upton Road are four-family units of brick or stucco with large porches. There are seven bungalows on Hetherington Loop with basements and fireplaces. A small housing area is located near the airfield. Houses are large stucco and tile structures.
Company Grade Officer/ Warrant Officer	17 6 100 120	17 12 172 180	17 12 169 176	1934 1940 1952 1960	Poor Poor Poor 92 Good, 28 Fair	Single-family and duplex units of tile and stucco are on Knox Road and Hudnutt Road. The 1100 area has three- and four-bedroom ranch style houses. Artillery Village is the largest housing area on the reservation; units are three- and four-bedroom ranch style houses.

K. URBAN AREA (CANTONMENT AREA)
(Continued)

FAMILY HOUSING (Continued)

TYPE	NUMBER OF BUILDINGS	NUMBER OF FAMILY UNITS	CURRENT LOAD*	YEAR OF CONSTRUCTION	CONDITION†	REMARKS
Noncommissioned Officers	3	4	4	1870	1 Good, 3 Poor	Most of the NCO housing is in Artillery Village, 5500 and 5700 areas. Structures are ranch style with three and four bedrooms.
	1	1	1	1880	Poor	
	5	10	10	1911	2 Fair, 3 Poor	
	1	2	2	1916	Poor	The 2000 area has recently renovated, four-bedroom duplexes.
	1	2	2	1917	Poor	
	15	20	19	1933	Poor	
	17	22	21	1934	Poor	There are three-bedroom single units and two-bedroom duplexes along Lawson Road.
	17	34	32	1939	Poor	
	1	1	1	1940	Good	
	4	32	31	1950	1 Good, 3 Poor	There are no plans to expand family housing in the near future. It is estimated that 7000 families live off post; adequate housing is currently available in the Lawton area for these families.
	185	231	221	1952	Poor	
	84	168	161	1960	62 Good, 22 Fair	
	53	106	101	1963	32 Good, 21 Fair	
	26	52	50	1964	21 Good, 5 Fair	
Total	816	1315	1273 (96.8 percent occupancy)		241 Good, 85 Fair, 491 Poor	

*Current load based on figures for March 1980.

†Based on the condition code devised for the Integrated Facilities System Report and derived from a formula of 10 weighted inspection components. This formula yields C₁ — satisfactory = Good; C₂ — marginal (needs minor repairs, painting, etc.) = Fair; and C₃ — unsatisfactory (needs major work, painting, etc.) = Poor. A “Poor” building is not necessarily inadequate, but requires work which could bring it up to a better condition.

SCHOOLS AND MEDICAL FACILITIES

TYPE	CAPACITY	CURRENT LOAD	REMARKS
SCHOOLS			
Child Care Center	100	100	The child care center is located in two buildings. One is classified as substandard; the other was built in 1870. Plans call for eventual replacement of both buildings with one new structure.
Pre-School	80	60	The pre-school is in a World War II structure under renovation. The school is staffed through outside contracts.
Elementary Geronimo Road Sheridan Road	760 620	689 562	Both elementary schools at Fort Sill are operated by the Lawton Public School District. All upper grades attend school in the City of Lawton.
Vocational Education	No data	120	Vocational education classes are taught on a demand basis at Fort Sill. Typical offerings include auto mechanics, welding, and typing.
Continuing Education	No data	300	Faculty from the University of Oklahoma conduct weekend classes in eight Master's level programs. Classes are open to both military and civilian personnel and members of surrounding communities.
MEDICAL FACILITIES			
Hospital Reynolds Army Hospital (building number 4700)	250 beds	Average patient load— 125 per day	The hospital was built in 1965 and contains 17,651 m ² (190,000 ft ²) of usable space. Personnel and administrative offices are located in building number 4705. A 26-million-dollar expansion plan is scheduled to begin in 1986.
Clinic Facilities	10 units		Several clinics are located in the hospital, including an internal medicine clinic, two family practice clinics for dependents, and an acute minor illness clinic. Clinics off hospital grounds include an eye clinic, a mental health clinic, and four troop medical clinics.
Dental Clinics Building number 2442 Building number 2779 Building number 4535 Building number 6037	24 chairs 27 chairs 12 chairs 28 chairs		A 38-chair clinic is under construction on Randolph Road. It will replace the clinics now housed in buildings numbers 2779 and 4535.

RECREATIONAL FACILITIES

TYPE	CAPACITY	REMARKS
OUTDOOR FACILITIES		
2 Golf courses 1 Driving range		An 18-hole golf course and driving range are located behind Reynolds Army Hospital. The clubhouse is in building number 4746. A second 18-hole golf course on the reservation is managed by a private association.
19 Tennis courts		Lighted tennis courts and a tennis pro shop are located at 601 Upton Road. Other lighted courts are at 1020 Upton Road and in the 2800 area.
6 Swimming pools		All pools were constructed during World War II. Two pools, one at the Officers' Club and one at the NCO Club, are restricted to members, their families, and guests. Pools are operated May through September.
22 Playgrounds		Scattered throughout family housing areas.
5 Parks		Four parks contain picnic areas with tables, barbeque pits, and playground equipment.
2 Football fields		Prichard Field, in the 1600 area, is used for youth sports programs. A new football field has been built in the 6000 area, but it is not yet ready for use.
11 Softball fields		Two fields are in picnic areas. Others are scattered throughout the cantonment area. Five fields are lighted, and all fields have bleachers. One field is located in the confinement area.
2 Baseball fields		Both fields are part of the Youth Sports Complex in the 1600 area. The fields have bleachers, but are not lighted.
7 Running tracks		The only cinder track surrounds Prichard Field. Other tracks are scattered throughout the barracks areas.
1 Go-cart track		Located on a hardstand area adjacent to building number 3824. The track is pylon marked, 1/8-mile, oval.
30 Volleyball courts		Approximately 30 courts are scattered throughout the troop and family housing areas.
1 Polo field		Located in the 5700 area.
1 Zoo		A small children's zoo is maintained at the Outdoor Sportmen's Center.
1 Skeet range		Located in the 7000 area.
1 Archery range		In the Medicine Bluffs area (see Section L, Non-Urban Culture Features, for data).
Lake Elmer Thomas Recreation Area		LETRA is a 191-hectare (472-acre) lake used for fishing, boating, and swimming. There are mobile homes, travel trailer sites, and campgrounds which are available for overnight stays. See Section L, Non-Urban Culture Features, for additional information.
INDOOR FACILITIES		
4 Gymnasiums	one 1590 seats/1889 m ² (20,338 ft ²) one 2552 seats/2683 m ² (28,883 ft ²) 340 m ² (3663 ft ²) 1700 m ² (18,304 ft ²)	Honeycutt Gym (building number 921) and Goldner Gym (building number 3444) are the largest gymnasiums, containing basketball, squash, racketball, and handball courts, weight rooms, and exercise rooms. The Youth Gym (building number 5627) contains trampoline and tumbling equipment. The USAFATC Gym (building number 2711) is a small gym with basketball facilities.

K. URBAN AREA (CANTONMENT AREA)
(Continued)

RECREATIONAL FACILITIES (Continued)		
TYPE	CAPACITY	REMARKS
5 Theaters	340 m² (3663 ft²) 176 seats/1207 m² (12,994 ft²) 898 seats/1479 m² (15,921 ft²) 1000 seats/1595 m² (17,170 ft²) 1042 seats/1207 m² (12,994 ft²)	The Cabaret Theater houses the Fort Sill Dinner Theater. Four of the theaters are movie houses.
4 Music/entertainment centers		Centers include rehearsal rooms, musical instruments, and performance facilities.
1 Bowling center	36 lanes	Located in the 900 area. An additional facility is planned for the 3500 area.
2 Handball courts		Located in Honeycutt Gymnasium.
4 Basketball courts		Two courts are in Honeycutt Gymnasium and one is in Goldner Gymnasium. The court in the USAFATC Gym does not meet regulation standards.
2 Squash courts		Located in Honeycutt Gymnasium.
3 Racketball courts		Located in Goldner Gymnasium.
Outdoor Sportsmen's Center		Constructed in 1976 to consolidate the activities of various outdoorsmen's clubs. Meeting rooms are available, fishing and hunting licenses can be obtained, and overlay maps of the ranges are posted daily to avoid personal injury due to firing.
4 Recreation centers	438 m² (4720 ft²) 1446 m² (15,568 ft²) 1987 m² (21,389 ft²) 2573 m² (27,705 ft²)	Caisson Recreation Center is the newest facility, built in 1974. Carrousel Recreation Center is a converted World War II barracks, and Kinetic Recreation Center is a World War II recreation center. Cannon Recreation Center was built in 1911. All of the facilities contain lounges, television rooms, game rooms, and kitchens. More than 30 other buildings are also used for various recreational purposes.
4 Libraries		The Morale Support Activities Center maintains three libraries. Nye Library is the main facility with 80,000 volumes. Branch libraries are operated in the 3500 area and in the confinement center. Reynolds Army Hospital maintains its own library.
2 Crafts centers		The main crafts center houses shops for woodworking, jewelry, leather, ceramics, and photography. Auto crafts are in a separate building.
1 Museum		The U.S. Army Field Artillery and Fort Sill Museum occupies several buildings in the Old Post. The museum is open to the public.

TELECOMMUNICATIONS

TYPE	CAPACITY AND CURRENT LOAD	REMARKS
Official Telephone	5200 dial telephone lines; 3205 lines currently in service— 7496 instruments	The communications-electronics systems at Fort Sill are owned, operated, and maintained by the Government through the U.S. Army Communications Command on the reservation.
	103 trunks	Seventy two-way local trunks connect to Lawton, OK. Twenty incoming and 13 outgoing long distance trunks connect to Lawton.
	Five-position switchboard	Processes non-dialed calls; provides operator assistance; handles fire reports.
	Two-position switchboard	Range control.
	One private automatic exchange (PAX)	Fort Sill National Bank.
	49 AUTOVON network trunks	Fifteen trunks are for incoming calls only. Thirty-four trunks are for both incoming and outgoing calls. All trunks connect to the Mounds, OK, switch.
		The telecommunications system at Fort Sill is in good condition; most cable has been replaced since 1950. Capacity will be saturated within a year due to reliance on twisted pair equipment. Attempts are being made to switch to a broadband system to increase capacity.
Unofficial Telephone	No data	Southwestern Bell provides telephone service to all housing, quarters, and commercial establishments on the reservation.

ELECTRICITY

SUBSTATIONS	TRANSFORMERS	CAPACITY	LOAD	REMARKS
Substation #1	Two 15/20/25 MVA	50,000 kVA	Peak demand July 1979: 19,886 kW	Electricity is supplied via a 66 kV, three-phase transmission line owned by Public Service Company of Oklahoma (PSO). Power is provided by PSO and the Southwest Power Administration (SWPA).
Substation #2	Two 25 MVA	500 MVA	Annual consumption, 1979: 13,086 kW	Power is reduced to 13.2 kV for distribution at a PSO-owned substation, then further reduced to 4160 V at a Government-owned substation. Distribution is 13.2 kV overhead and 4160 V underground.
				Twenty-five to 35 percent of Fort Sill's power is provided by SWPA from hydroelectric sources; the remainder is produced by PSO from generating plants using fossil fuels.
				SWPA and PSO have sufficient reserves to satisfy Fort Sill's long-range growth plans.

NATURAL GAS

CAPACITY	CURRENT LOAD	REMARKS
679,680 m³ (24,000 x 10³ ft³)*	Maximum daily draw: 801,796 m³ (28,312 x 10³ ft³)† Consumption for 1979: 45,371,076 m³ (1,602,086 x 10³ ft³)	Arkansas-Louisiana Gas Company (ARKLA) supplies gas to Fort Sill through two 20.3-cm (8-in) lines operated at ±2687 x 10³ Pa (±390 lb/in²g) in winter and ±1723 x 10³ Pa (±250 lb/in²g) in summer. Fort Sill has installed an additional high pressure main, 689 x 10³ Pa (100 lb/in²g) in winter and 104 x 10³ Pa (15 lb/in²g) in summer, to directly supply remote areas.
		The gas network was installed over 50 years ago and is undergoing extensive renovation; steel and cast iron lines are being replaced with polyethylene lines.
		ARKLA estimates its reserves at 141,600 x 10⁸ m³ (5,000,000 x 10⁸ ft³) and is capable of meeting Fort Sill's needs for the next 10 years. ARKLA's storage capacity is 509,760 x 10³ m³ (18,000,000 x 10³ ft³).

*This is the maximum daily delivery specified in the original 1943 service agreement; no other data were available. Original agreement capacity is now being exceeded as required.

†Current load, calculated on "worst case" basis using 1979 data: 14,149,125 m³ (499,616 x 10³ ft³) (heaviest month of use, February 1979) divided by 30 days, multiplied by 1.7 (estimated peak load factor), equals 801,796 m³ (28,312 x 10³ ft³) maximum.

K. URBAN AREA (CANTONMENT AREA)
(Continued)

WATER SUPPLY

TYPE	CAPACITY	CURRENT LOAD*	REMARKS
SUPPLY	163.1 x 10 ⁶ Lpd (43.1 x 10 ⁶ gpd) [†]	Average daily consumption: 11 x 10 ⁶ to 15 x 10 ⁶ Lpd (3 x 10 ⁶ to 4 x 10 ⁶ gpd) Peak-day demand: 32 x 10 ⁶ Lpd (8.5 x 10 ⁶ gpd)	Fort Sill receives water through mains from the City of Lawton's supply and treatment facilities. Fort Sill has its own distribution system serving both a high zone and a low zone on the reservation; the low zone serves areas below 366 m (1200 ft) elevation. Lines range in diameter from 10.1 cm (4 in) to 61 cm (24 in); most lines are 15.2 cm (6 in) in diameter. Mains, pumping equipment, and storage capacity are adequate for present needs in the low zone. Pumping capacity will have to be expanded to meet future needs. Mains and storage capacity are adequate for present needs in the high zone, but additional pumping capacity is required to meet present demand. Future needs in the high zone will require additional storage capacity of 1,892,500 L (500,000 gal).
Lake Lawtonka Lake Ellsworth Lake Waurika			
TREATMENT	151.4 x 10 ⁶ Lpd (40.1 x 10 ⁶ gpd)		Fort Sill's water supply receives chlorine treatment at the City of Lawton's water treatment plant, 0.4 km (0.25 mi) south of Lawtonka Dam, in Medicine Park, OK.
STORAGE RESERVOIRS			
Elevated tanks (total)	10,408,750 L (2,750,000 gal)		All four elevated tanks at Fort Sill are equipped with altitude valves and "float" on-line.
Tank #1	1,892,500 L (500,000 gal)		Overflow elevation: 391.6 m (1285 ft).
Tank #2	2,838,750 L (750,000 gal)		Overflow elevation: 391.6 m (1285 ft).
Tank #3	3,785,000 L (1,000,000 gal)		Overflow elevation: no data.
Tank #4	1,892,500 L (500,000 gal)		Overflow elevation: 407 m (1335 ft).
Ground storage (total)	946,250 L (250,000 gal)		The one ground storage tank is used for fire protection and does not contain potable water. A fire-flow pump station, adjacent to the tank, is activated automatically by a fire alarm signal or a signal from the sprinkler system. This system minimizes the impact of fire flow on the distribution grid.

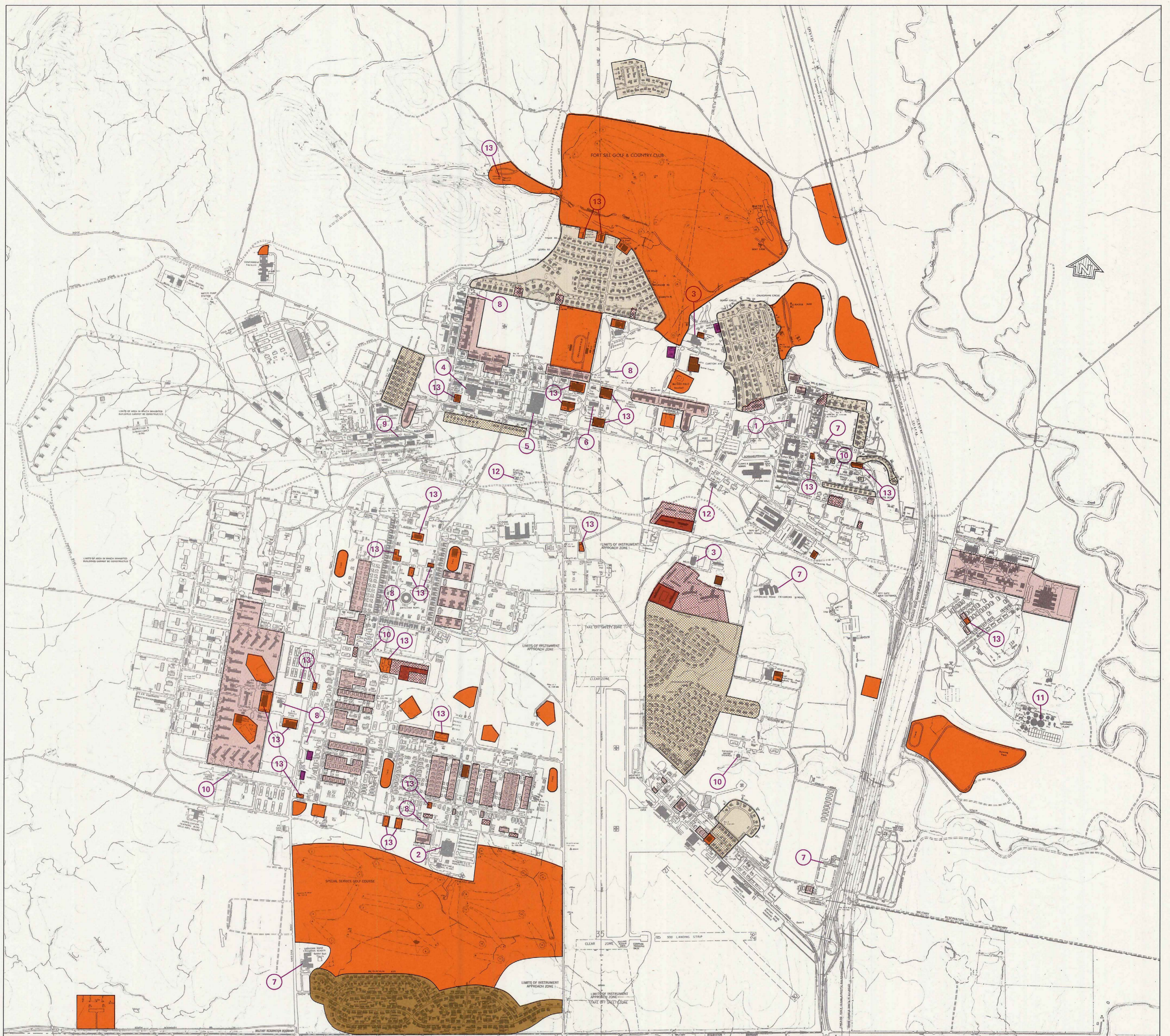
*Based on May 1980 figures.

[†]This is the total water supply available to the City of Lawton, which supplies Fort Sill; Lpd = liters per day, gpd = gallons per day.

SEWERAGE

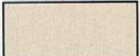



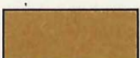

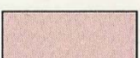

PLANT	CAPACITY	AVERAGE DAILY FLOW	PEAK RECORD FLOW	REMARKS
Sewage treatment plant	Average design capacity: 10.9 x 10 ⁶ Lpd (2.8 x 10 ⁶ gpd)* Maximum design capacity: 15.9 x 10 ⁶ Lpd (4.2 x 10 ⁶ gpd)	6.6 x 10 ⁶ Lpd (1.7 x 10 ⁶ gpd)	10.1 x 10 ⁶ Lpd (2.68 x 10 ⁶ gpd)	The sewage treatment plant and most of the collection system were built in the 1940's, but most of the system is still in good condition. The system includes approximately 108 km (67 mi) of separate sanitary sewerlines, ranging in diameter from 20 to 91 cm (8 to 36 in). Most lines are vitrified clay, although some concrete and cast iron lines still exist.
Pumping stations				Infiltration and inflow are relatively low; a majority of the sewerlines flow at less than one-third capacity. Adequate capacity is not available in all instances to accommodate expansion plans. New sewerage facilities have been proposed where the existing system is deficient.
Station 1	Two pumps— 189.2 Lpm (50 gpm) 18 foot head			The City of Lawton treats sewage from Artillery Village and maintains the connecting 25.4-cm (10-in) main to its sewage treatment plant.
Station 2	Two pumps— 265 Lpm (70 gpm) 28 foot head			
Station 3	Two pumps— 379 Lpm (100 gpm) 18 foot head			
Station 4	Two ejectors 757 Lpm (200 gpm) 30 foot head			

*Lpd = liters per day, gpd = gallons per day, Lpm = liters per minute, gpm = gallons per minute.
















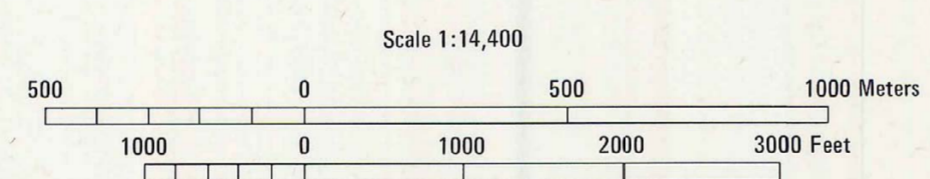
FORT SILL, OKLAHOMA **TERRAIN ANALYSIS** **URBAN AREA (CANTONMENT AREA)**

AREA FEATURES

	Family Housing, Officers		Bachelor Officers' Quarters
	Family Housing, NCO		Bachelor Enlisted Quarters
	Family Housing, Officers/NCO		Guest Houses
	Barracks, Troop Quarters		Recreation Facilities

POINT FEATURES

	Post Headquarters		Chapel
	Post Hospital		Directorate of Facilities Engineering
	Officers' Open Mess		Elevated Water Storage Tank
	Post Exchange		Sewage Treatment Plant
	Commissary		Electric Power Substation
	Post Office		Recreation Facility, Indoor
	Dependent School		



Prepared by Dames & Moore, Washington, DC, under the direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1980.

L. NON-URBAN CULTURE FEATURES

On the Fort Sill reservation, there are over 310 manmade features outside the cantonment area which could either positively or negatively affect military training or operations. Most of these features, depicted on the accompanying map and described below, consist of various types of buildings, cemeteries, revetments, and towers, many of which are associated with the various ranges on the reservation. For reasons of protection, approximately 30 significant archaeological sites on the reservation have not been plotted; for specific information, contact the Directorate of Facilities Engineering, Environmental and Natural Resources Conservation Division. The manmade features that are described and mapped are those that existed as of June 1980.

MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	228390	Ten concrete pads, each 37 m² (400 ft²), spaced approximately 15 m (50 ft) apart; two latrines ₍₁₎ ; foundation, approximately 74 m² (800 ft²), concrete.	42	347355	Eight tent pads, each 59 m² (640 ft²), concrete; eight shower pads, each 30 m² (320 ft²), concrete; water vault, depth 2.7 m (9 ft), area 24 m² (256 ft²), concrete, steel manhole on top, abandoned but filled with water; shower facility with hot water tank, inactive; shed, 5.9 m² (64 ft²), metal.
2	239388	Ruins: Walls of two buildings, native stone; grain storage bin, wood.	43	353346	Communications central link building, 19 m² (203 ft²), concrete, permanent; two radio towers, height each approximately 46 m (150 ft), steel; survey marker ₍₂₎ .
3	231383	Survey marker ₍₂₎ .	44	356348	Latrine ₍₁₎ .
4	225378	Latrine ₍₁₎ .	45	357350	Ruins: Concrete walls of three structures.
5	237361	Ruins: Walls and foundations of three structures, concrete.	46	375354 to 377354	Fence, barbed wire; gate, metal.
6	224360	Survey marker ₍₂₎ .	47	378341	Latrine ₍₁₎ .
7	224356	Observation tower, height 6.1 m (20 ft), steel, triangular base, triangular supports, guy wired.	48	385344	Survey marker ₍₂₎ .
8	225344	Observation tower, height 21.3 m (70 ft), base 3.4 m² (36 ft²), steel lattice, bolted to four concrete pads, guy wired.	49	353408	Survey marker ₍₂₎ .
9	239329	Observation tower, height 9.1 m (30 ft), aluminum and steel, three latticed supports of uncovered platform, guy wired, temporary; tower, height 12.2 m (40 ft), steel, scaffold design, open platform, guy wired.	50	369411	Seismic observation device, steel cylinder and metal cabinet on concrete pad, 3.3 m² (36 ft²), abandoned.
10	245335	Ten concrete pads, each 37 m² (400 ft²), spaced approximately 15 m (50 ft) apart; foundation, approximately 74 m² (800 ft²), concrete; latrine ₍₁₎ ; tower remnant, height 3 m (10 ft), base 2.3 m² (25 ft²), wood.	51	366404	Survey marker ₍₂₎ .
11	258356	Post Oak Creek Mission (historic site): Building foundations, concrete and native stone.	52	369415	Bleachers, 100-person capacity.
12	256361	Exploded building walls and foundation, reinforced concrete; piled shell casings and debris; survey marker ₍₂₎ .	53	374411	Distribution transformer building, 23 m² (249 ft²), concrete foundation, concrete and steel construction, permanent; burned ruins of astronomical and geophysical facility; building foundation, concrete.
13	253381	Observation tower, height 9.1 m (30 ft), base 13.4 m² (144 ft²), aluminum and steel lattice, guy wired, temporary.	54	373408	Picnic shelter, stone; several picnic benches, stone; latrine ₍₁₎ ; water well building, 3.3 m² (36 ft²), concrete, permanent.
14	262384	Observation tower, height 12.8 m (42 ft), base 5.9 m² (64 ft²), steel, scaffold design.	55	374405	Latrine ₍₁₎ .
15	271376	Ruins: Four to six buildings, native stone.	56	380403	Seismic observation device, steel cylinder and metal cabinet on concrete pad, 3.3 m² (36 ft²), abandoned.
16	276383	Observation tower, height 15.2 m (50 ft), base 13.4 m² (144 ft²), steel lattice, guy wired, shed on top, temporary.	57	374402	Picnic shelter, 44.6 m² (480 ft²), stone, open sides; several picnic benches and fireplaces, stone; boat ramp, concrete.
17	286381	Ruins: Walls of two structures, stone.	58	383384	Survey marker ₍₂₎ .
18	284379	Ruins: Foundations of several structures, concrete.	59	400393	Ruins: Concrete foundations of several buildings.
19	289383	Observation tower, height 30.5 m (100 ft), base 37.1 m² (400 ft²), steel lattice, shed on top, temporary.	60	391402	Running Deer Girl Scout Camp: Building, 135 m² (1452 ft²), concrete foundation, wood and stone construction, permanent; three latrines ₍₁₎ ; several picnic benches; rectangular, wire fence enclosing area.
20	270333	Observation tower, height approximately 9 m (30 ft), wood.	61	392403	Survey marker ₍₂₎ .
21	274336	Ruins: Cellar, concrete.	62	387411	Survey marker ₍₂₎ .
22	282338	Falcon Range (strafing impact area): Two observation towers, each height 7.6 m (25 ft), base 13.4 m² (144 ft²), steel, scaffold design; two range buildings, one 111 m² (1200 ft²), one 145 m² (1560 ft²), each sheet metal construction; two sheds, one 7.4 m² (80 ft²), one 4.5 m² (48 ft²), metal; spherical shelter, approximate diameter 4.6 m (15 ft), steel; latrine ₍₁₎ ; strafing targets, linear arrangements of wooden poles and old tires.	63	408415	Survey marker ₍₂₎ .
23	288343	Ruins: Portion of wall, concrete.	64	407407	Survey marker ₍₂₎ .
24	305342	Survey marker ₍₂₎ .	65	414395	Latrine ₍₁₎ .
25	321337	Latrine ₍₁₎ .	66	411389	Survey marker ₍₂₎ .
26	316351	Latrine ₍₁₎ .	67	421405	Survey marker ₍₂₎ .
27	322365	Quanah Parker's House (historic site).	68	430419	Several picnic shelters, each approximately 21 m² (225 ft²), stone; concrete pad, 3.3 m² (36 ft²).
28	311366	Ruins: Building foundations, concrete.	69	426422	Survey marker ₍₂₎ .
29	324376	Survey marker ₍₂₎ .	70	436418	Survey marker ₍₂₎ .
30	333370	Ruins: Building foundations, concrete.	71	445420	Lake Elmer Thomas Recreation Area: Boat storage building, 167 m² (1800 ft²), reinforced concrete foundation, steel construction; post exchange building, 89 m² (960 ft²), wood, temporary; administration building, 120 m² (1300 ft²), concrete, wood; two caretakers' buildings, one 61 m² (660 ft²), metal, one 65 m² (700 ft²), concrete and wood; water filter building, 17 m² (180 ft²), concrete; latrine, 37 m² (398 ft²), concrete, wood, permanent; bathhouse, 189 m² (2036 ft²), concrete, wood roof, semi-permanent; water treatment plant building, 40 m² (432 ft²), concrete foundation, steel construction; general purpose building, 5.9 m² (64 ft²), steel, wood, temporary; pumphouse, 17 m² (180 ft²), concrete, wood, permanent; three sheds, each 10 m² (108 ft²), metal; picnic shelter(3); ten mobile home sites, five sites occupied by mobile homes, each 61 m² (660 ft²); boat dock, 55 m (180 ft) along shoreline, concrete; offshore boat dock, 111 m² (1200 ft²), with 9 m (30 ft) access walkway, wood; water storage tank, diameter 2.4 m (8 ft), steel; four propane tanks, one(4), three 3 m (10 ft) long, steel; boat ramp, length 9 m (30 ft), width 6 m (20 ft), concrete; two sewage lagoons, 91 m (300 ft) long × 52 m (170 ft) wide × 3 m (10 ft) deep, enclosed by fence.
31	336373	Ruins: Four building foundations, concrete.	438421		Recreation building, approximately 120 m² (1300 ft²), concrete, wood, brick; picnic shelter(3); boat pier, 9 m² (96 ft²), wood; picnic grounds; playground area; boat ramp, length 10.4 m (34 ft), width 3.7 m (12 ft), concrete.
32	334376	Ruins: Building foundations and walls, concrete and stone.	and		
33	338369	Ammunition area, seven U-shaped earthen protection berms and one linear berm.	446423		Picnic shelter(3); several picnic tables, stone, concrete; two latrines ₍₁₎ .
34	350380	Survey marker ₍₂₎ .	72	422369	Blue Beaver Target Range: Moving target track, rails approximately 201 m (660 ft) long, steel; earthen berm, approximately 236 m (775 ft) long; two buildings, one 20 m² (216 ft²), one 54 m² (576 ft²), concrete and cinder block; observation platform, height 3 m (10 ft), base 3.3 m² (36 ft²), wood.
35	342369	Two detached shower buildings, each 59 m² (640 ft²), concrete foundation, wood, temporary; four vertical water tanks, each 56,775-L (15,000-gal) capacity, metal; two propane tanks, one 946-L (250-gal) capacity, one 1892-L (500-gal) capacity, both steel.	73	419355	Survey marker ₍₂₎ .
36	360372	Two latrines ₍₁₎ ; two concrete pads, approximately 11 m² (120 ft²).	74	418354	Blockhouse, 21 m² (225 ft²), concrete, stone, wood.
37	345365	Four tent pads, each 59 m² (640 ft²), concrete; four shower pads, each 30 m² (320 ft²), concrete.	75	407334	Blue Beaver Driving Range: General instruction building, 158 m² (1706 ft²), concrete foundation, steel construction, semipermanent; building, 36 m² (384 ft²), wood; five latrines ₍₁₎ ; storage tank, length 3 m (10 ft), steel, cylindrical; jeep driving course with tires and other obstacles.
38	342361	Primary Noncommissioned Officer (NCO) Course: Five buildings, each approximately 22 m² (240 ft²), wood; six buildings, each approximately 74 m² (800 ft²), wood; three grandstands, each 50-person capacity; training obstacle, concertina wire, fence posts; concertina wire surrounding course.	76	422334	Survey marker ₍₂₎ ; latrine ₍₁₎ .
39	344363	Camp Eagle: Two general purpose administration buildings, one 13.4 m² (144 ft²), concrete foundation, wood construction, temporary, one 35 m² (377 ft²), concrete, permanent; post exchange branch, 139.4 m² (1500 ft²), concrete construction, metal roof, permanent; visitor reception center, 269 m² (2900 ft²); caretaker's house, 197.8 m² (2129 ft²), concrete foundation, wood construction, semipermanent; regimental headquarters building, 508.5 m² (5474 ft²), concrete foundation, concrete, stone, and wood construction, permanent; officers' open mess, 360 m² (3875 ft²), concrete, stone, and wood, permanent; telephone exchange building, 66.9 m² (720 ft²), concrete construction, wood roof, permanent; storage shed, 5.9 m² (64 ft²), wood, temporary; ruins of several structures, concrete foundations; pumphouse, concrete, stone; two latrines ₍₁₎ ; six buildings, each 74 m² (800 ft²), sheet metal; four grandstands, each 50-person capacity.	77	427344	Ruins: Blockhouse, concrete walls and foundation, no roof.
40	348361	Nine tent pads, each 59 m² (640 ft²), concrete; nine shower pads, each 30 m² (320 ft²), concrete; water vault, depth 3 m (10 ft), area 24 m² (256 ft²), concrete, steel manhole on top, abandoned; shower facility, abandoned.	78	429345	Machine Gun and Antiaircraft Range: Earthen berm, approximately 132 m (430 ft) long; two latrines ₍₁₎ .
41	342359	Two tent pads, each 74 m² (800 ft²), concrete; two sewage lagoons, each 85 m (280 ft) long × 40 m (130 ft) wide × 5 m (15 ft) deep.	79	439331	Two latrines ₍₁₎ .
			80	437343	Survey marker ₍₂₎ .
			81	452330	Survey marker ₍₂₎ .

L. NON-URBAN CULTURE FEATURES (Continued)

MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	GRID REFERENCE	DESCRIPTION
82	451346	Live Rocket M72 Range, Practice Rocket Launcher Range, and M79 Range: Two observation towers, approximate height 6 m (20 ft), wood; two grandstands, 100-person capacity; one latrine _{1} .	133	520393	Three latrines _{1} .
			134	514392	Latrine _{1} .
83	464348	Shelter, 8.9 m² (96 ft²), stone and concrete, partially underground, abandoned; well structure, height 1 m (3 ft), area 2.3 m² (25 ft²), concrete, abandoned.	135	526394	Bunker, 93 m² (1000 ft²), concrete.
			136	520401	Mangus POW Camp (historic site).
84	472346	Survey marker _{2} .	137	519409	Demonstration training area: Seven grandstands, six 250-person capacity, one 150-person capacity; observation tower, height 6 m (20 ft), base 9.3 m² (100 ft²), wood construction, open base; six latrines _{1} .
85	483328	Survey marker _{2} .			
86	485339	Ruins.	138	522411	Survey marker _{2} ; grandstand, 50-person capacity, temporary.
87	497348	Grandstands, total capacity approximately 3500 persons, permanent; observation tower, height approximately 6 m (20 ft), 74 m² (800 ft²), three decks, wood, concrete; aircraft loading training aid, 37 m (120 ft) long, steel framework, concrete base.	139	530409	1936 boundary marker, height 1 m (3 ft), concrete pyramid.
			140	531398	Survey marker _{2} .
			141	539400	Survey marker _{2} .
88	506330	Survey marker _{2} .	142	540403	Five howitzer bays _{8} .
89	498348	Moway House (historic site).	143	529392	Ka-ah-tennay POW Camp (historic site).
90	501352	General storehouse, 66.9 m² (720 ft²), reinforced concrete foundation, wood construction, semipermanent; two latrines _{1} .	144	534385	Archery Range: Two sheds, one 3.3 m² (36 ft²), one 11.1 m² (120 ft²), each metal; two latrines _{1} .
91	500360	Observation bunker, 139 m² (1500 ft²), concrete.			
92	469368	Simpson Gun Memorial (historic site).	145	532389	Picnic area: Shed, 104 m² (1120 ft²), wood, open sides; six latrines _{1} ; numerous picnic tables and fireplaces; playground and ballfield.
93	467368	Signal Mountain (historic site): Survey marker _{2} ; blockhouse, concrete.	146	530382	Building, approximately 41.8 m² (450 ft²); survey marker _{2} .
94	500367	Observation platform, height 9.1 m (30 ft), diameter 3 m (10 ft), concrete.	147	532377	Building, approximately 86 m² (928 ft²), concrete, wood; latrine _{1} .
95	496374	Observation bunker, 139 m² (1500 ft²), concrete.	148	536381	Rappelling tower, height 11.6 m (38 ft), base 25 m² (270 ft²), wooden platform and supports, steel reinforced, temporary; suspension bridge, steel cable and rope; rappelling platform on cliff face; latrine _{1} ; concrete pad, 1.5 m² (16 ft²); Medicine Bluffs monument (historic site).
96	500385	Chatto POW Camp (historic site).			
97	489397	Survey marker _{2} .	149	520376	Camp Doniphan (historic site).
98	501397	Tom POW Camp (historic site).	150	526369	Tracked and wheeled vehicle parking area, enclosed by fence.
99	500410	Five latrines _{1} .	151	538377	Medicine Bluff 2 (pistol range): Range building, approximately 297 m² (3200 ft²), concrete, wood; building, approximately 80 m² (860 ft²), wood; two latrines _{1} ; five howitzer bays _{8} .
100	483404	Basic Defensive Tactics Course: Observation tower, height 10.7 m (35 ft), base 5.9 m² (64 ft²), wood; three grandstands, one 250-person capacity, two 50-person capacity; four waiting shelters _{5} ; latrine _{1} .	152	539378	Building, approximately 5.9 m² (64 ft²), concrete; survey marker _{2} .
101	466416	Latrine _{1} .	153	542377	Medicine Bluff 1 (pistol and rifle range): Range building, approximately 129 m² (1392 ft²), concrete, wood; two latrines _{1} ; target area enclosed by earthen berms.
102	476414	Latrine _{1} .			
103	480415	Two bivouac shelters _{6} ; mess shelter _{7} .	154	542378	Building, approximately 8.9 m² (96 ft²), concrete.
104	474424	Fence, chain link and barbed wire, encloses manmade ponds.	155	540384	Fence, height 1.2 m (4 ft).
105	497416	Survey marker _{2} .	156	544383	Shelter, 3.3 m² (36 ft²), concrete.
106	500413	Latrine _{1} .	157	537384	Captain Marcy's Camp (historic site); two howitzer bays _{8} .
107	502419	Survey marker _{2} .	158	537386	Bunker, 41.6 m² (450 ft²), concrete.
108	506411	Survey marker _{2} .	159	541387	Survey marker _{2} .
109	515406	Two latrines _{1} .	160	543392	Range building, 28 m² (300 ft²), concrete, wood; latrine _{1} ; survey marker _{2} ; three howitzer bays _{8} .
110	515400	To-clan-ny POW Camp (historic site).			
111	506400	Latrine _{1} .	161	537389	Apache Mission (historic site).
112	511391	Bunker, 70 m² (750 ft²), concrete; grandstand, 300-person capacity, temporary; five howitzer bays _{8} .	162	546394	Horse jumping field: Numerous obstacle fences spaced across field; six howitzer bays _{8} in northwest corner; latrine _{1} in south corner.
113	504395	Bunker, 70 m² (750 ft²), concrete.	163	544408	Survey marker _{2} ; boundary marker, height 1 m (3 ft), concrete pyramid.
114	507390	Jones Ridge Rifle Range: Four observation platforms, height 3 m (10 ft), wood, temporary; six earthen berms, each approximately 46 m (500 ft) long; two latrines _{1} .	164	545407	Five howitzer bays _{8} .
			165	546404	Eight howitzer bays _{8} .
115	507384	Four Mile Crossing (historic site).	166	553403	Nine howitzer bays _{8} .
116	510382	Nachez POW Camp (historic site).	167	552401	Noche POW Camp (historic site).
117	507374	Latrine _{1} .	168	570398	Tay-i-tah POW Camp (historic site).
118	508367	Tower Two (historic site): Observation platform, height 9.1 m (30 ft), diameter 3 m (10 ft), concrete, abandoned; communications central link building, 44.6 m² (480 ft²), reinforced concrete, permanent; survey marker _{2} ; latrine _{1} .	169	578413	Cemetery, Comanche: Enclosed by fence, height 1 m (3 ft), iron.
			170	578414	Ruins: Bridge piers, wooden.
			171	577403	Latrine _{1} .
119	506356	Applied instruction building, 44.6 m² (480 ft²), reinforced concrete foundation, wood construction, temporary; latrine _{1} .	172	577407	Survey marker _{2} ; latrine _{1} .
120	515345	Water pumping station, 106.3 m² (1144 ft²), reinforced concrete foundation, steel construction, permanent; station enclosed by fence, height 2.4 m (8 ft), area 1839 m² (19,800 ft²), chain link topped with barbed wire; two buildings, each 7.4 m² (80 ft²), concrete.	173	579399	Cemetery, Apache North.
			174	569392	Geronimo POW Camp (historic site).
121	515337	Building, height 1.2 m (4 ft), 3.3 m² (36 ft²), concrete.	175	577394	Cemetery, Apache: Burial site of Geronimo.
122	518330	Skeet Range: Four skeet target ejection buildings, height approximately 3.7 m (12 ft), base 5.9 m² (64 ft²), wood; building, approximately 58 m² (620 ft²); two waiting shelters, 33.4 m² (360 ft²), concrete foundation, wood construction, temporary; building, approximately 14 m² (155 ft²); latrine _{1} .	176	586393	Survey marker _{2} .
			177	579391	Sanitary landfill.
			178	571382	Survey marker _{2} .
123	523342	Multistory building, approximately 1680 m² (18,100 ft²), concrete, steel; tank parking area, fence, encloses building and parking area, chain link and barbed wire, survey marker _{2} .	179	571381	Perico POW Camp (historic site).
			180	587377	Survey marker _{2} .
124	519354	Football field; baseball field surrounded by light poles; shed, 37 m² (400 ft²), metal; two latrines _{1} .	181	576364	Caddo Crossing (historic site).
			182	586369	Three howitzer bays _{8} .
125	517378	Range house _{9} ; latrine _{1} .	183	586363	Five howitzer bays _{8} .
126	520368	Post ammunition storage area*: Six ammunition huts, 37.2 m² (400 ft²), spaced approximately 122 m (400 ft) apart, reinforced concrete foundation, steel construction, temporary; igloo storage, bunkers spaced approximately 61 m (200 ft) apart, reinforced concrete, earth covered, permanent; surfaced open storage area; enclosed by fence.	184	579358	Camp Comanche (historic site).
			185	586347	Survey marker _{2} .
			186	581346	Lime Kilns (historic site).
127	513373	Survey marker _{2} .	187	590340	Bivouac shelter _{6} ; latrine _{1} ; building, 35.7 m² (384 ft²), metal, wood; shed, 9.3 m² (100 ft²), metal, wood.
128	519376	Range house _{9} ; three howitzer bays _{8} ; shelter, 18 m² (192 ft²).	188	583335	Motorcycle riding course.
129	515381	Two range houses _{9} ; latrine _{1} ; bunker, 139 m² (1500 ft²), concrete.	189	587337	Practice Grenade Range: Two buildings, each 35.7 m² (384 ft²), wood.
130	525375	Provost office, 78 m² (840 ft²), concrete and wood; two kennel buildings, concrete and wood, temporary; fence enclosing kennel, height 2.4 m (8 ft), enclosed area approximately 410 m² (4400 ft²); fenced dog running area, approximately 2248 m² (24,200 ft²).	190	589344	Latrine _{1} ; bunkers, concrete.
			191	598342	Observation tower, height 7.6 m (25 ft), base 22.3 m² (240 ft²), wood; grandstand, 250-person capacity; two latrines _{1} ; two sheds, 5.9 m² (64 ft²), metal.
131	512389	Indian Spring (historic site); Loco POW Camp (historic site).			
132	515388	Observation shed, 12 m² (130 ft²); survey marker _{2} .			

L. NON-URBAN CULTURE FEATURES (Continued)

MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	GRID REFERENCE	DESCRIPTION
192	598339	Survey marker(2).	236	336343 to 226391	Range communication, Quannah Range (line 4)(14).
193	603338	Lake George monument, height approximately 1 m (3 ft), metal plate in rock.	237	224330 to 320330 335336 to 480423	Powerline, Western Farmers Electric Cooperative: 138 kV, aerial aluminum cable, steel reinforced (ACSR); H-frame wood poles, 18.3 m (60 ft) high; wire suspended on pole approximately 12.2 m (40 ft) aboveground, minimum wire ground clearance between poles approximately 7.9 m (26 ft); 30.5-m (100-ft) wide right-of-way.
194	607356	Underground bunker, approximately 111 m² (1200 ft²), concrete.			
195	608373	Underground bunker, approximately 111 m² (1200 ft²), concrete.	238	249328 to 269328	Powerline, Cotton Electric Cooperative: Single phase, 7200 V; 10.7-m (35-ft), class seven, single poles; two-wire #4 7/1 ACSR; one 5 kVA, pole-mounted transformer.
196	609389	Communications central link building, 61.3 m² (660 ft²), reinforced concrete, permanent; range house(9); survey marker(2); auto junkyard; latrine(1).	239	270336 to 270329	Range communication(15).
197	597387	Five howitzer bays(8).	240	283335 to 283329	Range communication(15).
198	602393	Range building, 120 m² (1300 ft²), concrete, wood; latrine(1); general storehouse, 23.8 m² (256 ft²), concrete foundation, wood construction, temporary; survey marker(2); Dodge Hill monument (historic site).	241	336367 to 335376	Range communication, Quannah Range (line 4B)(14).
			242	336363 to 344363	Range communication, Quannah Range (line 4A)(14).
199	604396	Underground bunker, 102 m² (1100 ft²), concrete.	243	337336 to 337376	Powerline, Cotton Electric Cooperative: Three phase, 7200/12,470 V; 10.7-m (35-ft), class three, single poles; three-wire 1/0-6/1 ACSR with one wire # 2 6/1 ACSR neutral.
200	602398	Five howitzer bays(8).			
201	614403	Underground bunker, 120 m² (1300 ft²), concrete.	244	507367 to 353346	Range communication, West Range (line 2)(14).
202	601414	Four howitzer bays(8).	245	354338 to 353346	Government-owned feeder power cable: 7200 V.
203	594418	Survey marker(2).	246	354328 to 354338	Powerline, Cotton Electric Cooperative: Single phase, 7200 V; 10.7-m (35-ft), class seven, single poles; two-wire # 6 aerial copper wire conductors (ACWC); one 7.5 kVA, pole-mounted transformer.
204	603429	Record Fire Range 1: Observation tower, height 4.9 m (16 ft), base 5.9 m² (64 ft²), wood, both levels enclosed; mess shelter(7); two bivouac shelters(6); detached latrine building(10); range house, 33.1 m² (356 ft²), reinforced concrete foundation, wood construction, semipermanent; grandstand, 250-person capacity; two waiting shelters(5); shed, approximately 17.8 m² (192 ft²), metal; two earthen berms, each approximately 381 m (1250 ft) long.	247	354340 to 357371	Range communication, West Range (line 5)(14).
			248	359412 to 418328 371411 to 370403	Range communication, West Range (line 2H)(14).
205	608443	Latrine(1).	249	352411 to 362408	Range communication, West Range (line 2H8)(14).
206	615448	25 Meter Complex I: General storehouse, 37.4 m² (403 ft²), concrete, wood roof, permanent; range house(11); detached latrine building(10); observation tower(12); applied instruction building(13); mess shelter(7); two waiting shelters(5); storage tank(4); two bivouac shelters(6); earthen berm, approximately 190 m (625 ft) long.	250	405389 to 406391	Range communication, West Range (line 2H7)(14).
			251	406391 to 416392	Range communication, West Range (line 2H9)(14).
207	618453	Field Fire Complex 1: Range house(11); detached latrine building(10); observation tower(12); applied instruction building(13); mess shelter(7); two bivouac shelters(6); two waiting shelters(5); shed, 8.9 m² (96 ft²), metal; storage tank(4); eleven concrete storage pads, each 47.6 m² (512 ft²); three earthen berms, each approximately 170 m (560 ft) long.	252	410385 to 408382	Range communication, West Range (line 2H6)(14).
			253	418379 to 417372	Range communication, West Range (line 2H5)(14).
			254	400367 to 416366	Range communication, West Range (line 2H4)(14).
			255	408334 to 408328	Range communication, West Range(14).
208	628468	Survey marker(2).	256	395333 to 395328	Range communication, West Range (line 2J)(14).
209	644461	Survey marker(2).	257	418343 to 357343	Range communication, West Range (line 5C)(14).
210	655466	Gas well, Fort Sill No. 1, belonging to Westheimer-Neustadt Corporation: Wellhead; pump and meter; fence, height 1.2 m (4 ft); enclosed area is 58 x 76 m (190 x 250 ft), barbed wire.	258	371343 to 371352	Range communication, West Range (line 5C1)(14).
			259	466344 to 418343	Range communication, West Range (line 2G1)(14).
211	655463	Gas well, Fort Sill No. 2, belonging to Westheimer-Neustadt Corporation: Wellhead and pump.	260	466347 to 466329	Range communication, West Range (line 2G)(14).
212	655440	Oil well, inactive.	261	445419 to 438421	Government-owned powerline: Single phase, 7200 V; two-wire # 2 ACSR; 12.2-m (40-ft) poles, classes three and four; three pole-mounted transformers, one 37.5 kVA, one 5 kVA, one 15 kVA.
213	651437	Survey marker(2).	262	461422 to 446420	Government-owned powerline: Single phase, 7200 V; two-wire # 2 ACSR; 10.7-m (35-ft) poles, classes four and five.
214	654432	Field Fire Range 2: Range house(11); detached latrine building(10); observation tower(12); applied instruction building(13); latrine(1); two bivouac shelters(6); mess shelter(7); two waiting shelters(5); earthen berm, approximately 320 m (1050 ft) long.	263	460422 to 464412 466416 to 544380 544379 to 541375	Range communication, West Range (line 1A)(14).
215	628433	Survey marker(2).	264	485410 to 483410	Range communication, West Range (line 1A4A)(14).
216	655429	25 Meter Complex II: Range house(11); detached latrine building(10); observation tower(12); two bivouac shelters(6); mess shelter(7); two waiting shelters(5); two latrines, one(1), one 8.9 m² (96 ft²), wood and sheet metal; shed, 22.3 m² (240 ft²), metal, wood; grandstand, 250-person capacity.	265	482413 to 484405	Range communication, West Range (line 1A4)(14).
			266	495421 to 495413	Range communication, West Range (line 1A3)(14).
217	655425	Survey marker(2).	267	540399 to 547400	Range communication, West Range (line 1A1)(14).
218	655423	Two sheds, 7.4 m² (80 ft²), wood, open sides.	268	540399 to 509391 502393 to 515396 530404 to 528394 528395 to 527395	Range communication(15).
219	634403	Underground bunker, approximately 120 m² (1300 ft²), concrete.	269	541375 to 507367	Range communication, West Range (line 1)(14).
220	620397	Underground bunker, 130 m² (1400 ft²), concrete.	270	529377 to 529383	Range communication, West Range (line 1B)(14).
221	614391	Three range houses(9); latrine(1); four howitzer bays(8).	271	515386 to 517378	Range communication, West Range (line 1C1)(14).
222	623390	Survey marker(2); five howitzer bays(8).	272	512382 to 515382	Range communication, West Range (line 1C1A)(14).
223	637390	Survey marker(2).	273	519377 to 506392	Range communication, West Range (line 1C)(14).
224	640390	Survey marker(2).	274	507382 to 502385	Range communication, West Range (line 1C3)(14).
225	649399	Potato Hill Rifle Range: Two range houses, each 71.8 m² (773 ft²), reinforced concrete, permanent; two grandstands, each 250-person capacity; observation tower(12); latrine(1).	275	507375 to 507382	Range communication, West Range (line 1C3A)(14).
			276	507373 to 507375	Range communication(15).
226	656397	Two latrines(1).	277	514373 to 493373	Range communication, West Range (E cable)(14).
227	651395	Latrine(1).	278	507373 to 507367	Range communication, West Range (line 1E)(14).
228	654370	Record Fire Range 2: Range house(11); detached latrine building, 17.8 m² (192 ft²), reinforced concrete foundation, wood construction, semi-permanent; observation tower, height 4.9 m (16 ft), base 5.9 m² (64 ft²), wood, both levels enclosed; mess shelter(7); two bivouac shelters(6); shed, 5.9 m² (64 ft²), metal; grandstand; two earthen berms, approximately 366 m (1200 ft) long.	279	490357 to 522358	Range communication, West Range (E cable)(14).
			280	507350 to 522344 525330 to 498329	Range communication, West Range (line 2C)(14).
229	657331	Latrine(1).	281	498344 to 504344	Range communication, West Range (line 2F)(14).
230	634333	Survey marker(2).	282	489350 to 497346	Range communication, West Range (line 2D)(14).
231	634348	Survey marker(2).	283	567368 to 558402	Powerline, Public Service Company of Oklahoma: Phase to phase, 69,000 V; ACSR; two pole H-frame construction, 18.3 m (60 ft) high; wire suspended on poles approximately 12.2 m (40 ft) aboveground, minimum wire ground clearance between poles approximately 7.9 m (26 ft); 30.5-m (100-ft) wide right-of-way.
232	620334	Survey marker(2); Arbuckle Hill monument (historic site).			
233	566336 to 635473 634473 to 618473 617473 to 594458 594457 to 594427 569401 to 557403 556403 to 554409 562381 to 443424 337376 to 524329 336376 to 224392	Boundary fence, height 1.2 m (4 ft), barbed wire.	284	568400 to 586344	Range communication, East Range (line 1A2)(14).
			285	563386 to 564382	Range communication, East Range (line 1A2A)(14).
			286	565377 to 569389	Range communication, East Range (line 1A)(14).
			287	575391 to 580393	Range communication, East Range (line 1C1)(14).
234	354340 to 336336 320336 to 226391	Range communication, Quannah Range (line 3)(14).	288	566368 to 553409	Buried cable, Southwestern Bell Telephone.
			289	580392 to 602393	Range communication, East Range (line 1C)(14).
235	431424 to 337376 336376 to 224392	Boundary fence, height 2.4 m (8 ft), 1.8 m (6 ft) of wire mesh with three strands of barbed wire on top.	290	656469 to 574364	Range communication, East Range (line 1)(14).

L. NON-URBAN CULTURE FEATURES (Continued)

MAP NUMBER	GRID REFERENCE	DESCRIPTION	MAP NUMBER	GRID REFERENCE	DESCRIPTION
291	602395 to 601393	Range communication, East Range (line 1D){14}.	301	656427 to 653427 653424 to 653430	Powerline, Cotton Electric Cooperative: Single phase, 7200 V, 10.7-m (35-ft), class seven, single poles; two-wire # 6 ACWC; eleven 3 kVA and one 5 kVA pole-mounted transformers.
292	609390 to 657400	Range communication, East Range (line 1B){14}.	302	647399 to 647396	Range communication, East Range (line 1B2){14}.
293	599413 to 601413	Range communication, East Range (line 1E){14}.	303	649396 to 651392	Range communication, East Range (line 1B3){14}.
294	593425 to 600425	Range communication, East Range{14}.	304	657371 to 655371	Powerline, Cotton Electric Cooperative: Single phase, 7200 V; 10.7-m (35-ft), class six, single poles; two-wire # 6 ACWC; one 5 kVA pole-mounted transformer.
295	593425 to 618451 615449 to 616448 601432 to 603430	Powerline, Cotton Electric Cooperative: Single phase, 7200 V; 10.7-m (35-ft), class seven, single poles; two-wire #4 7/1 ACSR; two 3 kVA and one 5 kVA, pole-mounted transformers.	305	642337 to 653343	Range communication {15}.
296	601450 to 610442	Range communication, East Range (line 1H){14}.	306	645331 to 642337	Range communication, East Range (3 pair cable){14}.
297	594427 to 634473	Telegraph line: 6-m (20-ft) pole, two wood crossarms.	307	621337 to 619329	Range communication, East Range (line OF-15){14}.
298	617473 to 602465 601464 to 594458 594457 to 601463 602464 to 618473	Fence, height 1.2 m (4 ft), wire mesh with two strands of barbed wire on top.	308	597334 to 599329	Range communication {15}.
299	656457 to 651464	Powerline, Cotton Electric Cooperative: Single phase, 7200 V; 10.7-m (35-ft), class seven, single poles; two-wire #6 ACWC; one 5 kVA pole-mounted transformer.	309	597340 to 394331	Government-owned powerline: Single phase, 7620 V; # 2 aluminum cable; 10 kVA transformer.
300	579345 to 593331 595330 to 642337 653343 to 656438	Range communication, East Range (line 2){14}.	310	518329 to 518331	Powerline, Public Service Company of Oklahoma: Two spans of 7620 V line, one span of 120/240 V line; 13.7-m (45-ft) and 9.1-m (30-ft) poles; one pole-mounted transformer.

FOOTNOTES:

*Additional undescribed ammunition storage facilities exist within the bounds of the cantonment area.

- Subscript
Number
- (1) Latrine, 7.4 m² (80 ft²), wood and sheet metal, temporary.
 - (2) Survey marker, height 4.7 m (15.5 ft), tripod design metal tower, concrete footings.
 - (3) Picnic shelter, 84 m² (900 ft²), native stone, wood, open sides.
 - (4) Storage tank, 4.9 m (16 ft) long, steel, cylindrical.
 - (5) Waiting shelter, 4.5 m² (48 ft²), wood, open sides.
 - (6) Bivouac shelter, 47.6 m² (512 ft²), wood frame, sheet metal roof, open sides.
 - (7) Mess shelter, 66.9 m² (720 ft²), wood construction, shingle roof, open sides.
 - (8) Howitzer bay, approximately 6.7 m² (72 ft²), concrete, U-shaped, abandoned.
 - (9) Range house, 73.7 m² (792 ft²), reinforced concrete foundation, wood construction, temporary.
 - (10) Detached latrine building, 17.8 m² (192 ft²), stone foundation, wood construction, semipermanent.
 - (11) Range house, 32.7 m² (352 ft²), reinforced concrete foundation, wood construction, semipermanent.
 - (12) Observation tower, height 4.9 m (16 ft), base 5.9 m² (64 ft²), wood, open bottom, enclosed platform.
 - (13) Applied instruction building, 78.8 m² (848 ft²), reinforced concrete foundation, steel construction, semipermanent.
 - (14) Range communication, 9.1-m (30-ft) poles with zero to three crossarms, copper wire.
 - (15) Range communication, underground cable, copper wire, buried to a depth of 0.8 m (2.7 ft).

III. OFF-POST FEATURES

A. AIRFIELDS

Three airfields within an 80-kilometer (50-mile) radius of Fort Sill will support aircraft as large as C-130A's. Lawton Municipal Airport, approximately 11 kilometers (7 miles) south of Fort Sill, shares radar approach equipment with Fort Sill's Henry Post Airfield. Sheppard Air Force Base and Wichita Falls Municipal Airport, approximately 77 kilometers (48 miles) south of Fort Sill, share the runways, taxiways, and control tower at the base under a 50-year lease that Wichita Falls Municipal Airport has with Sheppard Air Force Base.

Altus Air Force Base, which will support aircraft as large as the C-5, is just outside the 80-kilometer (50-mile) radius of this study to the west. It is included because Fort Sill has a troop mobilization agreement with the base. Altus Air Force Base also uses Fort Sill for some training exercises.

NAME; LOCATION; CLASSIFICATION; AND TYPE	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
Altus Air Force Base; 34° 40' N, 99° 16' W; Air Force; Airfield.	420 m (1378 ft); operational.	North-South Runway 17-35 4096.5 x 91.4 m (13,440 x 300 ft); azimuth, 171°-351°; maximum weight bearing capacity, S145, T245, ST175, TT330, TDT800, AUW800*; portland cement concrete central runway touchdown areas, remainder of runway is asphalt.	<u>Taxiways</u> Approximately five; taxiway 4 is closed until further notice; taxiway 3 closed to aircraft over 9072 kg (20,000 lb) takeoff weight; two taxiways are 22.9 m (75 ft) wide and two are 15.2 m (50 ft) wide; weight bearing capacities not available; portland cement concrete. <u>Parking Apron and Hardstand Area</u> 528,638 m² (5,690,400 ft²); maximum weight bearing capacity not available; concrete.	<u>Hangars and Maintenance Facilities</u> Five buildings; all hangars are used as maintenance facilities; building number 285 approximately 15,387 m² (165,627 ft²) and 14 m (45 ft) high, corrugated metal; building number 435 approximately 7872 m² (84,735 ft²) and 34 m (110 ft) high, corrugated metal; building number 510 approximately 1330 m² (14,319 ft²) and 21 m (70 ft) high, corrugated metal; building number 515 approximately 1139 m² (12,263 ft²) and 21 m (70 ft) high, corrugated metal; building number 518 approximately 3664 m² (39,445 ft²) and 21 m (70 ft) high. <u>Administration and Terminal Building</u> Building number 285, combined hangar, maintenance, and administration building, has approximately 830 m² (8942 ft²) of administrative space.	<u>Tanks</u> U.S. aviation fuel (MIL-SPECS) JP-4: three tanks, total capacity 10,809,960 L (2,856,000 gal). MoGas: one tank, capacity 609,650 L (161,070 gal). <u>Trucks</u> No data. <u>Oil and Lubrication Facilities</u> The following are available: reciprocating engine oil, jet engine oil, turbine engine oil, spectrometric oil analysis program.	<u>Control Tower</u> 30 m (97 ft) high. VHF omnidirectional range (VOR); tactical air navigation (TACAN), unusable 060°-070° beyond 22 km (12 nmi ¹) below 1524 m (5000 ft); instrument landing system (ILS); runway 35 outer marker (OM) not installed, distance measuring equipment (DME) or radar required. <u>Lights</u> Rotating beacon; high intensity runway lights; high intensity approach lights; sequenced flashing lights; visual approach slope indicator systems.	Heavy/Jumbo jet training surface to 2134 m (7000 ft) within 46-km (25-nmi) radius. Unlighted 425-m (1394-ft) obstruction 1034 m (3391 ft) south and 286 m (938 ft) west of departure end runway 17 centerline extension. Transient maintenance and parts support extremely limited. Visual approach slope indicator (VASI) does not coincide with precision approach radar/instrument landing system (PAR/ILS) glide slope.
Lawton Municipal Airport; 34° 34' N, 98° 25' W; Civil; Airfield.	338 m (1110 ft); operational.	North-South Runway 17-35 2621 x 46 m (8600 x 150 ft); azimuth, 169°-349°; maximum weight bearing capacity, S75, T106, ST135, TT175; 33-cm (13-in) portland cement concrete surface with plastic grooving.	<u>Taxiways</u> Approximately six. Four are 23 m (75 ft) wide; weight bearing capacities are the same as runway; portland cement concrete surface. Two taxiways to general aviation facilities and hangars; 12 m (40 ft) wide; weight bearing capacities are 13,608 kg (30,000 lb) and 5670 kg (12,500 lb); asphalt surface. <u>Parking Apron and Hardstand Area</u> 48,173 m² (518,543 ft²) approximate total area; weight bearing capacity same as runway, except for general aviation aprons which have a weight bearing capacity of 5670 kg (12,500 lb); portland cement concrete surface except for general aviation aprons which are asphalt.	<u>Hangars</u> Two buildings; approximate total area, 5574 m² (60,000 ft²); 9.1 m (30 ft) high; corrugated metal. <u>Maintenance Facilities</u> One building, approximate total area, 2787 m² (30,000 ft²); prefabricated metal; fair condition. <u>Administration and Terminal Building</u> Approximate total area, 920 m² (9900 ft²); brick construction; excellent condition.	<u>Tanks</u> Jet A-1 kerosene: 75,700 L (20,000 gal). Grade 100 gasoline low lead: 45,420 L (12,000 gal). Supplied by Phillips Petroleum Company. <u>Trucks</u> One 8516-L (2250-gal) truck for jet fuel; one 3785-L (1000-gal) truck for gasoline.	<u>Control Tower</u> 16.5 m (54 ft) high. Scheduled weather broadcast, combination VOR and TACAN (VORTAC); ILS back course unusable, unmonitored when tower not operating. <u>Lights</u> Rotating beacon; runway or strip lights; approach lights; high intensity runway lights; sequenced flashing lights; visual approach slope indicator systems; runway end identifier lights.	Long range plans include a crosswind runway for general aviation aircraft.
Sheppard Air Force Base/ Wichita Falls Municipal Airport; 33° 59' N, 98° 30' W; Air Force/Civil; Airfield; Wichita Falls Municipal Airport has a 50-year lease with Sheppard Air Force Base.	309.4 m (1015 ft); operational.	<u>Northwest-Southeast Runway 15R-33L</u> 3993 x 91 m (13,100 x 300 ft); azimuth, 150°-330°; maximum weight bearing capacity, S155, T220, ST175, TT540, TDT 800, DTT800; 48.3-cm (19-in) portland cement concrete. <u>Northwest-Southeast Runway 15L-33R</u> 2682 x 46 m (8800 x 150 ft); azimuth 150°-330°; maximum weight bearing capacity, S50, T90, ST115, TT160, TDT 420; asphalt concrete. <u>North-South Runway 17-35</u> 2134 x 46 m (7000 x 150 ft); azimuth, 170°-350°; maximum weight bearing capacity, S75, T125, ST160, TT225, TDT570; asphalt concrete.	<u>SHARED FACILITIES</u> <u>Taxiways</u> Approximately nine; 22.9 m (75 ft) wide; maximum weight bearing capacities range from S30 to 350, T90 to 450, ST120 to 730, TT145A to 720, TDT 260 to 2720; portland cement concrete and asphalt concrete. <u>CIVILIAN FACILITIES</u> <u>Taxiways</u> One taxiway used solely by Wichita Falls Municipal Airport; 15.2 m (50 ft) wide; maximum weight bearing capacity, S60, T65, ST125, TT145A, TDT510; portland cement concrete. <u>Parking Apron and Hardstand Area</u> 38,461 m² (414,000 ft²) approximate total area; maximum weight bearing capacity and type of surface not available. <u>MILITARY FACILITIES</u> <u>Parking Apron and Hardstand Area</u> 402,582 m² (5,333,500 ft²) approximate total area; maximum weight bearing capacities range from S19 to 235, T40 to 440, ST65A to 550, TT65A to 600, TDT520 to 2030; portland cement concrete and asphalt concrete.	<u>CIVILIAN FACILITIES</u> <u>Hangars</u> Three large open-bay hangars, one T-hangar; hangar #1 approximate area 1805 m² (19,427 ft²); 9.1 m (30 ft) high; hangar #2 approximate area 2234 m² (24,045 ft²); 13.7 m (45 ft) high; hangar #3 approximate area 1393 m² (15,000 ft²); 9.1 m (30 ft) high; hangar #4 approximate area 1014 m² (10,912 ft²); 6 m (20 ft) high; all hangars corrugated metal and steel. <u>Maintenance Facilities</u> Hangar #1 has set-aside maintenance areas; approximate area 268 m² (2880 ft²). <u>Administration and Terminal Buildings</u> Hangar #1 has approximately 111 m² (1200 ft²) of administrative space; hangar #2 has approximately 780 m² (8400 ft²) of administrative space. Administration building, approximate area 595 m² (6407 ft²), brick, good condition. Terminal building, approximate area 1756 m² (18,900 ft²), brick, good condition. <u>MILITARY FACILITIES</u> <u>Hangars and Maintenance Facilities</u> Five hangars; all are used for aircraft maintenance; hangars numbers 1 and 2 approximate area 2631 m² (28,319 ft²) each, 15 m (49 ft) high; hangars numbers 3 and 4 approximate area 1866 m² (20,081 ft²) each, 15 m (49 ft) high; hangar number 5 approximate total area 10,972 m² (118,103 ft²), 15 m (49 ft) high; all hangars are corrugated metal. Building number 2325 also used for maintenance, approximate total area 2475 m (26,640 ft²). Approximately 4739 m² (51,016 ft²) of building number 2320 used for maintenance.	<u>CIVILIAN FACILITIES</u> <u>Tanks</u> Jet fuel type A: two tanks, total capacity 136,260 L (36,000 gal). Aviation gasoline: three tanks, total capacity 136,260 L (36,000 gal). Motor gasoline: one tank, capacity not available. Fuel supplied by Exxon. <u>Trucks</u> Three trucks for jet fuel type A, total capacity 20,439 L (5400 gal). One truck for aviation fuel, capacity 2839 L (750 gal). <u>MILITARY FACILITIES</u> <u>Tanks</u> Jet fuel JP-4: underground storage 7630 L (2016 gal), aboveground storage 5,563,950 L (1,470,000 gal); 16 underground tanks with total capacity of 3,026,789 L (799,680 gal) have been deactivated. Aviation gasoline: one deactivated tank 94,587 L (24,990 gal). Motor gasoline: four tanks, total capacity 240,363 L (63,504 gal). Fuel supplied by Pride Oil Company. <u>Trucks</u> Twelve pumping trucks for JP-4, capacities range from 14,762 L (3900 gal) to 20,439 L (5400 gal). One truck for motor gasoline, capacity 7570 L (2000 gal). <u>Oil and Lubrication Facilities</u> The following are available: 1010 jet engine oil, turbine engine oil, turboprop and turbo-shaft engine oil, spectrometric oil analysis program.	<u>Control Tower</u> 36.6 m (120 ft) high. TACAN, unusable 150°-200° and 345°-355° beyond 20 km (11 nmi) below 2438 m (8000 ft); VORTAC, continuous automatic transcribed weather broadcasts service; VHF direction finder, call Wichita Falls radio. <u>Lights</u> Rotating beacon; approach lights runway 15R-33L; high intensity runway lights; high intensity approach lights; sequenced flashing lights; visual approach slope indicator systems.	Military aerodrome operates 1400-0159 international time. Light aircraft traffic pattern 457 m (1500 ft). Conventional and multi-engine jet traffic pattern 701 m (2300 ft). Joint-use field. Obstructions to aircraft operations on or near runway 15R.

III. OFF-POST FEATURES (Continued)

A. AIRFIELDS (Continued)

NAME; LOCATION; CLASSIFICATION; AND TYPE	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
Sheppard Air Force Base/ Wichita Falls Municipal Air- port (Continued)				<u>Administration and Terminal Buildings</u> Hangar number 5 contains approximately 1921 m ² (20,675 ft ²) of administrative space. Building number 2320 con- tains approximately 6999 m ² (75,336 ft ²) of administrative space, masonry and steel con- struction. Main terminal, building num- ber 1700, approximate area 493 m ² (5307 ft ²), masonry and steel construction.			

*Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT, TDT, DTT, AUW. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.

S- Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F100).
T- Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).
ST- Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130).
TT- Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135).
TDT- Runway weight bearing capacity for aircraft with twin delta tandem landing gear (C-5).
DTT- Runway weight bearing capacity for aircraft with dual twin tandem landing gear (E4A, 747).
AUW- All up weight. Maximum weight bearing capacity for any aircraft irrespective of landing gear configuration.

†nmi = nautical miles.

B. URBAN AREAS

Ten urban areas within 80 kilometers (50 miles) of Fort Sill had 1970 census populations greater than 2500. Nine of these areas are in Oklahoma; one, Burkburnett, is in Texas.

Lawton, the largest urban area within the 80-kilometer (50-mile) radius, is also the urban area closest to Fort Sill. Its northern boundary is coincident with the reservation boundary. Various service agreements exist between Lawton and Fort Sill regarding schools, utilities, and recreational facilities. Ample housing is available in Lawton for military personnel; it is estimated that 7000 families currently live off-post and more could be accommodated. Because Lawton is generally able to meet the needs of the Fort Sill community, there has been little pressure for military personnel to locate in other urban areas.

The remaining nine urban areas are approximately 40 kilometers (25 miles) to 97 kilometers (60 miles)

driving distance from Fort Sill. With the exception of Lindsay, Marlow, and Burkburnett, all of the urban areas are seats of county government. Six of these areas have populations of less than 10,000. The three larger areas, Chickasha, Duncan, and Burkburnett, are experiencing substantial industrial development partially as a result of adequate supplies of natural gas and electricity; development in the smaller communities may be dependent on the oil industry. The availability of services, including schools, recreational and medical facilities, and utilities, is generally adequate in all of these urban areas, although the impact of Fort Sill on these communities has been small. Burkburnett, Texas, however, is affected by the presence of Sheppard Air Force Base, approximately 16 kilometers (10 miles) to the south.

The most recent data available were used to compile the table below.

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Anadarko, OK 35° 04' N 98° 14' W	1970: 6682 1977 est: 6900 1980 est: 7500 (1979 data)	<u>Single-Family Units</u> Total units: 2470 Owner-occupied units: 1482 Average sale price: \$27,500 Average monthly rent: \$275 to \$375 <u>Multi-Family Units</u> Total units: 368 Average monthly rent: \$175 to \$200 Included in the total number of multi-family units are 168 federally subsidized units. (1980 data)	<u>PUBLIC SCHOOLS</u> <u>2 Elementary Schools (grades K through 5)</u> 1980 enrollment: 836 Enrollment capacity: 800 <u>1 Middle School (grades 6 through 8)</u> 1980 enrollment: 411 Enrollment capacity: 500 <u>1 High School (grades 9 through 12)</u> 1980 enrollment: 619 Enrollment capacity: 700 A new high school will be completed within the next year, and the present high school will be converted to another middle school. (1980 data)	<u>Doctors</u> Total: 6 Ratio*: 1/1250 <u>Dentists</u> Total: 3 Ratio*: 1/2500 <u>Health Care Facilities</u> Anadarko Municipal Hospital 50 beds ICU/CCU† available 2 Nursing homes 316 beds (1980 data)	<u>Public</u> 3 Municipal parks 4 Lighted tennis courts 3 Lighted ball parks 1 Swimming pool 1 Library 1 Historic site 1 Museum 1 Camping area <u>Private</u> 1 Country club 1 18-hole golf course 2 Movie theaters 1 Bowling alley (1980 data)	<u>Electric</u> Municipal distribution system Source of supply: Public Service Company of Oklahoma Total generating capacity: 3,315,750 MW Supply: Adequate <u>Heating Fuels</u> Source of product: Natural gas from Oklahoma Natural Gas Company Supply: Adequate <u>Water Supply</u> Source: Fort Cobb Reservoir Treatment plant capacity: 12.3 x 10 ⁶ Lpd (3.2 x 10 ⁶ gpd)‡ Average daily consumption: 4.2 x 10 ⁶ L (1.1 x 10 ⁶ gal) Storage capacity: 8.7 x 10 ⁶ L (2.3 x 10 ⁶ gal) <u>Sewage Disposal</u> Municipal sewage treatment plant Design capacity: 3.8 x 10 ⁶ Lpd (1.0 x 10 ⁶ gpd) Average daily flow: 4.5 x 10 ⁶ L (1.2 x 10 ⁶ gal) Type of treatment: Aerated lagoon <u>Solid Waste</u> Municipal landfill (1980 data)
Burkburnett, TX 34° 05' N 98° 34' W	1970: 9230 1980 est: 13,000 1985 projection: 16,500 (1980 data)	<u>Single-Family Units</u> Total units: 4300 Owner-occupied units: 3655 Vacancy rate: 2 percent Average sale price: \$45,000 Average monthly rent: \$250 <u>Multi-Family Units</u> Total units: 80 Average monthly rent: 1 bedroom: \$125 2 bedroom: \$200 3 bedroom: \$250 (1980 data)	<u>PUBLIC SCHOOLS (BURK- BURNETT INDEPENDENT SCHOOL DISTRICT)</u> <u>3 Elementary Schools</u> (grades K through 5) 1980 enrollment: 1762 Enrollment capacity: at capacity <u>1 Junior High School</u> (grades 6 through 8) 1980 enrollment: 740 Enrollment capacity: at capacity <u>1 High School (grades 9 through 12)</u> 1980 enrollment: 1163 Enrollment capacity: at capacity Burkburnett High School offers extensive vocational edu- cation programs. Vernon Junior College contracts with the Community Education Department to conduct evening college classes in Burkburnett. (1980 data)	<u>Doctors</u> Total: 2 Ratio: 1/6500 <u>Dentists</u> Total: 4 Ratio: 1/3250 <u>Health Care Facilities</u> 1 Nursing home 60 beds Use Wichita Falls, TX, facilities. 24 kilometers (15 miles) south of Burk- burnett. (1980 data)	<u>Public</u> 5 Municipal parks 4 Lighted ballfields 8 Lighted tennis courts 1 All-weather track 1 Swimming pool 1 Football stadium 5 Gymnasiums 1 Youth center 1 Community center 1 Library <u>Private</u> 1 Bowling alley 1 Roller skating rink An 18-hole golf course is 8 kilometers (5 miles) southeast of Burkburnett. (1980 data)	<u>Electric</u> Source of supply: Texas Electric Service Company Total generating capacity: 4,743,382 kW Supply: Adequate <u>Heating Fuels</u> Source of product: Natural gas from Lone Star Gas Company Supply: Adequate 2 Propane distributors <u>Water Supply</u> Source: 100 wells and purchase from City of Wichita Falls Pumping capacity: 17.0 x 10 ⁶ Lpd (4.5 x 10 ⁶ gpd) Peak daily consumption: 11.4 x 10 ⁶ L (3.0 x 10 ⁶ gal) Storage capacity: 7.0 x 10 ⁶ L (1.85 x 10 ⁶ gal) <u>Sewage Disposal</u> Municipal sewage disposal plant Design capacity: 8.3 x 10 ⁶ Lpd (2.2 x 10 ⁶ gpd) Maximum daily flow: 6.0 x 10 ⁶ L (1.6 x 10 ⁶ gal) Type of treatment: Oxidation ditch/ activated sludge <u>Solid Waste</u> Municipal landfill (1980 data)

III. OFF-POST FEATURES (Continued)

B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Chickasha, OK 35° 02' N 97° 57' W	1970: 14,194 1978 est: 17,800 (1978 data)	Single-Family Units Total units: 5658 Owner-occupied units: 4186 Vacancy rate: <1 percent Average sale price: \$45,000 Average monthly rent: \$250 Multi-Family Units Average monthly rent: 1 bedroom: \$175 2 bedroom: \$275 There are two low-income housing projects in Chickasha. (1980 data)	PUBLIC SCHOOLS 6 Elementary Schools (grades K through 6) 1979 enrollment: 1583 Enrollment capacity: at capacity 1 Junior High School (grades 7 and 8) 1979 enrollment: 408 Enrollment capacity: at capacity 1 High School (grades 9 through 12) 1979 enrollment: 887 Enrollment capacity: at capacity VOCATIONAL SCHOOLS Canadian Valley Area Vocational Technical School has a satellite campus in Chickasha which offers courses in auto body/mechanics, health services, and drafting. COLLEGES AND UNIVERSITIES University of Science and Arts of Oklahoma (4-year liberal arts school) 1979 enrollment: 1289 Enrollment capacity: data not available (1980 data)	Doctors Total: 29 Ratio: 1/613 Dentists Total: 9 Ratio: 1/1977 Health Care Facilities Grady Memorial Hospital 156 beds 12 beds ICU/CCU Grady Memorial Hospital is operated by Grady County, one of three counties in Oklahoma with Emergency Paramedic Service. Chickasha Clinic (private facility on the grounds of the Grady medical complex) Chisholm Trail Mental Health Clinic 4 Nursing homes 300 beds (1980 data)	Public 4 Municipal parks (swimming pool, outdoor theater, tennis courts, playgrounds, football stadium, 6 baseball fields, 2 softball fields, children's zoo) Library Fairgrounds University of Science and Arts of Oklahoma has lighted tennis courts, a gymnasium, and an indoor swimming pool. The school also offers art exhibits and music festivals. The Community Concert Association presents four performances each year. Lake Chickasha, 21 kilometers (13 miles) northwest of Chickasha, is a city-owned recreational area for hunting, fishing, camping, and water sports. Private Chickasha Golf and Country Club (9-hole golf course, swimming pool, tennis courts) 2 Movie theaters 1 Skating rink 1 Bowling alley (1980 data)	Electric Source of supply: Public Service Company of Oklahoma Total generating capacity: 3,315,750 MW Supply: Adequate Heating Fuels Source of product: Natural gas from Arkansas-Louisiana Gas Company Supply: Adequate 4 Propane distributors (1980 data) Water Supply Source: Fort Cobb Reservoir, Washita River, and Lake Chickasha Treatment plant capacity: 60.6 x 10 ⁶ Lpd (16 x 10 ⁶ gpd) Average daily consumption: 9.5 x 10 ⁶ L (2.5 x 10 ⁶ gal) Peak daily consumption: 11.4 x 10 ⁶ L (3.0 x 10 ⁶ gal) Storage capacity: 61 x 10 ⁶ L (4 x 10 ⁶ gal) Sewage Disposal Municipal sewage disposal plant Design capacity: 11.4 x 10 ⁶ Lpd (3.0 x 10 ⁶ gpd) Average daily flow: 7.9 x 10 ⁶ L (2.1 x 10 ⁶ gal) Type of treatment: Activated sludge Solid Waste Municipal landfill (1978 data)
Duncan, OK 34° 30' N 97° 57' W	1970: 19,718 1980 est: 22,500 1985 projection : 23,400 (1977 data)	Single-Family Units Total units: 8900 Owner-occupied units: 6675 Vacancy rate: <1 percent Average sale price: \$45,000 Multi-Family Units Total units: 234 Average monthly rent: 1 bedroom: \$225 2 bedroom: \$285 (1980 data)	PUBLIC SCHOOLS 8 Elementary Schools (grades K through 6) 1980 enrollment: 2179 Enrollment capacity: 2400 1 Junior High School (grades 7 and 8) 1980 enrollment: 535 Enrollment capacity: 800 1 High School (grades 9 through 12) 1980 enrollment: 1170 Enrollment capacity: 1500 PRIVATE SCHOOLS Duncan Christian School (grades K through 12) 1980 enrollment: data not available VOCATIONAL SCHOOLS Red River Area Vocational Technical School 1980 enrollment: 550 Enrollment capacity: 600 The school offers vocational and continuing education curricula. (1980 data)	Doctors Total: 28 Ratio: 1/804 Dentists Total: 12 Ratio: 1/1875 Health Care Facilities Duncan Regional Hospital 152 beds ICU/CCU available 4 Nursing homes 352 beds (1979 data)	Public 8 Municipal parks 1 Swimming pool 7 Lighted baseball fields 2 Football stadiums 16 Tennis courts 1 Library 1 Museum 1 Gymnasium Private Elks Country Club (swimming pool, 18-hole golf course, tennis courts) 1 9-hole golf course 2 Movie theaters 1 Bowling alley 1 Roller skating rink 1 Swimming pool 1 Miniature golf course (1980 data)	Electric Service is provided by Public Service Company of Oklahoma (PSO), Cotton Electric Cooperative, and Duncan Power and Light Company. Source of supply: PSO, Southwest Power Administration, and Western Farmers Electric Cooperative Supply: Adequate Heating Fuels Source of product: Natural gas from Arkansas-Louisiana Gas Company Supply: Adequate 3 Propane distributors Water Supply Source: Three area lakes Treatment plant capacity: 30.3 x 10 ⁶ Lpd (8.0 x 10 ⁶ gpd) Average daily consumption: 11.4 x 10 ⁶ L (3.0 x 10 ⁶ gal) Peak daily consumption: 32.2 x 10 ⁶ L (8.5 x 10 ⁶ gal) Storage capacity: 39.7 x 10 ⁶ L (10.5 x 10 ⁶ gal) Type of treatment: Sand-filtered Sewage Disposal Municipal sewage disposal plant Design capacity: 11.4 x 10 ⁶ Lpd (3.0 x 10 ⁶ gpd) Average daily flow: 6.8 x 10 ⁶ L (1.8 x 10 ⁶ gal) Type of treatment: Trickling filter/lagoons Solid Waste Municipal landfill (1980 data)
Frederick, OK 34° 23' N 99° 01' W	1970: 6132 1980 est: 7000 1985 projection: 8270 (1980 data)	Single-Family Units Total units: 2409 Owner-occupied units: 1734 Vacancy rate: 1 percent Average sale price: \$35,000 Average monthly rent: \$170 Multi-Family Units Total units: 125 Average monthly rent: 2 bedroom: \$150 (1980 data)	PUBLIC SCHOOLS (FREDERICK INDEPENDENT SCHOOL DISTRICT) 5 Elementary Schools (grades K through 6) 1978 enrollment: 734 Enrollment capacity: 1000 Eight new classrooms will be ready for use in fall 1980. 1 Junior High School (grades 7 through 9) 1978 enrollment: 331 Enrollment capacity: data not available 1 High School (grades 10 through 12) 1978 enrollment: 311 Enrollment capacity: data not available (1978 data)	Doctors Total: 5 Ratio: 1/1400 Dentists Total: 3 Ratio: 1/2333 Health Care Facilities Tillman County Memorial Hospital 52 beds ICU/CCU available 1 Nursing home 100 beds (1980 data)	Public Municipal Park (swimming pool, picnic area, 3 lighted tennis courts, playground equipment) Jaycee Park (lighted ball-field, playground equipment) 2 Neighborhood parks 3 Baseball fields 2 Soccer fields 1 Football field 1 Library 1 Historic site Private Frederick Country Club (9-hole golf course, swimming pool) (1980 data)	Electric City of Frederick Light and Water Office Source of supply: Public Service Company of Oklahoma Total generating capacity: 3,315,750 MW Supply: Adequate Heating Fuels Source of product: Natural gas from Lone Star Gas Company Supply: Adequate 2 Propane distributors (1980 data) Water Supply Source: Primary is Lake Frederick, secondary is Lake Tom Steed. Five wells available for emergency purposes. Treatment plant capacity: 15 x 10 ⁶ Lpd (4.0 x 10 ⁶ gpd) Average daily consumption: 7.3 x 10 ⁶ L (1.9 x 10 ⁶ gal) Peak daily consumption: 11.4 x 10 ⁶ L (3.0 x 10 ⁶ gal) Storage capacity: 6.8 x 10 ⁶ L (1.8 x 10 ⁶ gal) Type of treatment: Chemical (1978 data) Sewage Disposal Municipal sewage disposal plant Design capacity: 2.4 x 10 ⁶ Lpd (0.64 x 10 ⁶ gpd) Average daily flow: 2.5 x 10 ⁶ L (0.66 x 10 ⁶ gal) (1978 data) A new sewage treatment plant with a design capacity of 5.0 x 10 ⁶ Lpd (1.3 x 10 ⁶ gpd) will be completed in early 1981. The plant is a pilot for the Environmental Protection Agency. It will be a lagoon-type plant with a sprinkling/irrigation system. Solid Waste Municipal landfill (1980 data)

III. OFF-POST FEATURES (Continued)

B. URBAN AREAS (Continued)

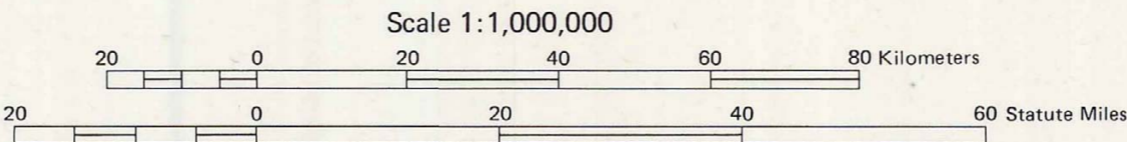
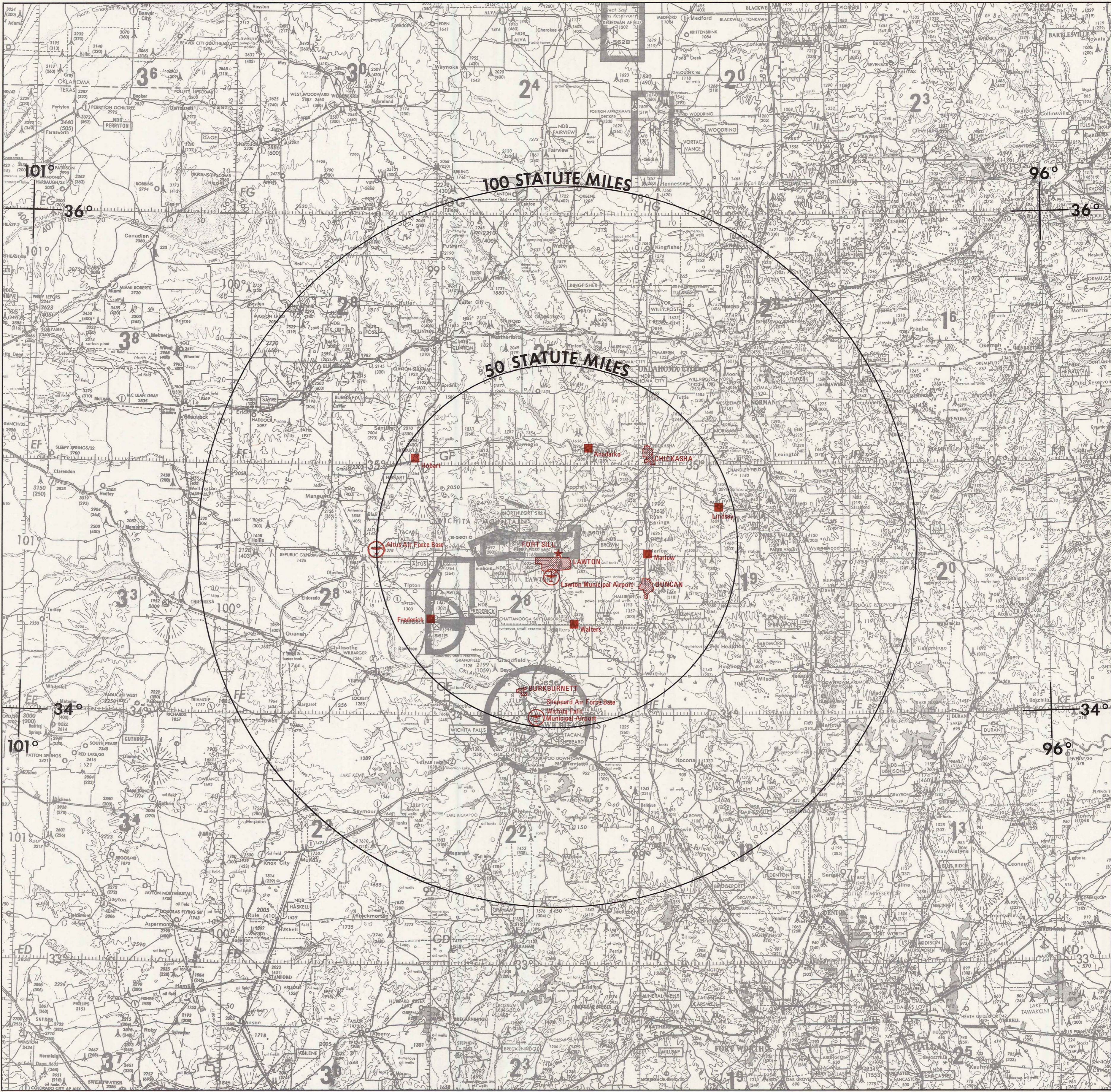
NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Hobart, OK 35° 01' N 99° 05' W	1970: 4638 1980 est: 5000 1985 projection: 6000 (1980 data)	Single-Family Units Total units: 2934 Owner-occupied units: 2259 Average sale price: New houses: \$50,000 Resale: \$25,000 (1979 data)	PUBLIC SCHOOLS <u>2 Elementary Schools (grades K through 6)</u> 1980 enrollment: 475 Enrollment capacity: 600	Doctors Total: 8 Ratio: 1/625 <u>Dentists</u> Total: 2 Ratio: 1/2500 <u>Health Care Facilities</u> Elkview General Hospital 50 beds 3 beds ICU/CCU (1980 data)	Public 4 Municipal parks 1 Lighted baseball field 4 Unlighted baseball fields 2 Softball fields 1 Football stadium 1 Swimming pool 2 Lighted tennis courts 1 Gymnasium Fairgrounds 1 Library Private Hobart Golf and Country Club (9-hole golf course, swimming pool, tennis courts) 1 Movie theater 1 Bowling alley (1980 data)	Electric Source of supply: Public Service Company of Oklahoma Total generating capacity: 3,315,750 MW Supply: Adequate Heating Fuels Source of product: Natural gas from Oklahoma Natural Gas Company Supply: Adequate Water Supply Source: Reservoir and lake Treatment plant capacity: 9.0 x 10 ⁶ Lpd (2.4 x 10 ⁶ gpd) Average daily consumption: 5.2 x 10 ⁶ L (1.4 x 10 ⁶ gal) Peak daily consumption: 7.6 x 10 ⁶ L (2.0 x 10 ⁶ gal) Storage capacity: 5.7 x 10 ⁶ L (1.5 x 10 ⁶ gal) Type of treatment: Chemical including chlorination Sewage Disposal Municipal sewage disposal plant Design capacity: 1.6 x 10 ⁶ Lpd (0.41 x 10 ⁶ gpd) Average daily flow: 2.0 x 10 ⁶ L (0.55 x 10 ⁶ gal) Type of treatment: Trickling filter <u>Solid Waste</u> Municipal landfill (1979 data)
	1970: 74,470 1979 est: 87,600 1985 projection: 94,000 (1979 data)	Single-Family Units Total occupied units: 29,040 Owner-occupied units: 17,972 Vacancy rate: 8.8 percent Average sale price: \$40,000 Average monthly rent: \$190 Mobile home monthly rent: \$169 (1980 data)	PUBLIC SCHOOLS <u>35 Elementary Schools (grades 1 through 6)</u> 1980 enrollment: 6868 Enrollment capacity: 7380 <u>4 Junior High Schools (grades 7 through 9)</u> 1980 enrollment: 3954 Enrollment capacity: 4250 <u>3 High Schools (grades 10 through 12)</u> 1980 enrollment: 4035 Enrollment capacity: 4330 PRIVATE SCHOOLS <u>Lawton Christian Academy (grades K through 10)</u> 1980 enrollment: 150 Enrollment capacity: 250 There are three other private schools in Lawton. One has students in grades K through 12. Two have students in grades 1 through 8. VOCATIONAL SCHOOLS <u>Great Plains Area Vocational Technical School</u> COLLEGES AND UNIVERSITIES <u>Cameron University (4-year arts and science curriculum)</u> 1980 enrollment: 5000 (1980 data)	Doctors Total: 65 Ratio: 1/1348 <u>Dentists</u> Total: 28 Ratio: 1/3129 (1979 data) <u>Health Care Facilities</u> Comanche County Memorial Hospital 252 beds ICU/CCU available Southwestern Clinic Hospital 127 beds ICU/CCU available Taliaferro Community Mental Health Center 32 beds 6 Nursing homes 523 beds (1977 data)	Public 76 City parks 1 Swimming pool 1 18-hole golf course 1 Library 1 Auditorium (1500 seats) 1 Community theater 2 Reservoirs 3 Historic sites 1 Museum 29 Tennis courts 3 Baseball fields 1 Coliseum Private 1 Country club 6 Movie theaters 2 Bowling alleys 1 Roller skating rink (1980 data)	Electric Source of supply: Public Service Company of Oklahoma (PSO) Total generating capacity: 3,315,750 MW Supply: Adequate PSO's plans for expansion call for a nuclear unit and a coal-fired unit. Heating Fuels Source of product: Natural gas from Arkansas-Louisiana Gas Company Supply: Adequate 3 Propane distributors <u>Water Supply</u> Source: Lakes Lawtonka, Ellsworth, and Waurika Treatment plant capacity: 114 x 10 ⁶ Lpd (30 x 10 ⁶ gpd) Average daily consumption 68 x 10 ⁶ L (18 x 10 ⁶ gal) Peak daily consumption: 98 x 10 ⁶ L (26 x 10 ⁶ gal) Storage capacity: 59.4 x 10 ⁶ L (15.7 x 10 ⁶ gal) Type of treatment: Flocculation sedimentation, filtration, chlorination Sewage Disposal Municipal sewage disposal plant Design capacity: 38 x 10 ⁶ Lpd (10 x 10 ⁶ gpd) Average daily flow: 36.0 x 10 ⁶ L (9.5 x 10 ⁶ gal) Type of treatment: Nitrification, phosphorus removal Planned expansion of the facility will increase its capacity to 49 x 10 ⁶ Lpd (13 x 10 ⁶ gpd). <u>Solid Waste</u> Municipal landfill (1980 data)
	1970: 3800 1980 est: 6000 1985 projection: 8000 (1980 data)	Single-Family Units Total occupied units: 1800 Owner-occupied units: 1700 Vacancy rate: <1 percent Average sale price: \$38,000 Average monthly rent: \$300 Multi-Family Units There is very little multi-family housing in Lindsay. (1980 data)	PUBLIC SCHOOLS (LINDSAY INDEPENDENT SCHOOL DISTRICT) <u>1 Elementary School (grades 1 through 6)</u> 1980 enrollment: 650 Enrollment capacity: 700 <u>1 High School (grades 7 through 12)</u> 1980 enrollment: 590 Enrollment capacity: 600 (1980 data)	Doctors Total: 5 Ratio: 1/1200 <u>Dentists</u> Total: 3 Ratio: 1/2000 <u>Health Care Facilities</u> Lindsay Municipal Hospital 28 beds 2 beds ICU/CCU 1 Nursing home 45 beds (1980 data)	Public 3 Municipal parks 3 Baseball fields 6 Tennis courts 1 9-hole golf course 1 Swimming pool 1 Library 1 Historic site/museum 1 Football field Private 1 Bowling alley 1 Movie theater 1 Skating rink (1980 data)	Electric City of Lindsay Light and Water Department Source of supply: Western Farmers Electric Cooperative Total generating capacity: 743,400 kW Supply: Adequate Heating Fuels Source of product: Natural gas from Oklahoma Natural Gas and Electric Company Supply: Adequate Water Supply City of Lindsay Light and Water Department Source: 13 wells Pumping capacity: 6 x 10 ⁶ Lpd (1.5 x 10 ⁶ gpd) Treatment plant capacity: 6.0 x 10 ⁶ Lpd (1.5 x 10 ⁶ gpd) Average daily consumption: 2.3 x 10 ⁶ L (0.6 x 10 ⁶ gal) Peak daily consumption: 3.2 x 10 ⁶ L (0.85 x 10 ⁶ gal) Storage capacity in two tanks: 7.6 x 10 ⁶ L (2.0 x 10 ⁶ gal) Type of treatment: Filtration, chlorination Sewage Disposal Municipal sewage disposal plant Type of treatment: Lagoon system <u>Solid Waste</u> Municipal landfill (1980 data)

III. OFF-POST FEATURES (Continued)

B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	UTILITIES AND SERVICES
Marlow, OK 34° 38' N 97° 57' W	1970: 3995 1980 est: 5500 1985 projection: 6500 (1977 data)	<u>Single-Family Units</u> Total units: 1870 Owner-occupied units: 1272 Vacancy rate: 3 percent (1978 data) Average sale price: \$35,000 <u>Multi-Family Units</u> Total units: Approximately 40 Average monthly rent: 2 bedroom: \$165 (1980 data)	PUBLIC SCHOOLS <u>1 Elementary School (grades K through 4)</u> 1980 enrollment: 600 Enrollment capacity: 700 <u>1 Middle School (grades 5 through 8)</u> 1980 enrollment: 450 Enrollment capacity: 600 <u>1 High School (grades 9 through 12)</u> 1980 enrollment: 450 Enrollment capacity: 600 COLLEGES AND UNIVERSITIES <u>Oklahoma Missionary Baptist College (accredited junior college)</u> (1980 data)	<u>Doctors</u> Total: 3 Ratio: 1/1833 <u>Dentists:</u> Total: 2 Ratio: 1/2750 Health Care Facilities Talley-Walker Hospital and Clinic 27 beds No ICU/CCU facilities 2 Nursing homes 155 beds (1980 data)	<u>Public</u> 2 Municipal parks 1 Swimming pool 6 Baseball fields 1 18-hole golf course 1 Football stadium 1 Historic site/park 1 Library Tennis courts (1980 data)	<u>Electric</u> Municipal distribution system Source of supply: Public Service Company of Oklahoma Total generating capacity: 3,315,750 MW Supply: Adequate Heating Fuels Source of product: Natural gas from Arkansas-Louisiana Gas Company Supply: Adequate 2 Propane distributors <u>Water Supply</u> Source: 24 wells Pumping capacity: data not available Average daily consumption: 3.0 x 10 ⁶ L (0.8 x 10 ⁶ gal) Peak daily consumption: 3.8 x 10 ⁶ L (1.0 x 10 ⁶ gal) Storage capacity: 4.0 x 10 ⁶ L (1.0 x 10 ⁶ gal) Type of treatment: None <u>Sewage Disposal</u> Municipal sewage disposal plant Design capacity: 1.9 x 10 ⁶ Lpd (0.5 x 10 ⁶ gpd) Average daily flow: Not metered A new sewage disposal system with a design capacity of 7.6 x 10 ⁶ Lpd (2.0 x 10 ⁶ gpd) will be in operation by the end of 1981. <u>Solid Waste</u> Municipal landfill (1980 data)
Walters, OK 34° 21' N 98° 16' W	1970: 2611 1980 est: 3000 (1980 data)	<u>Single-Family Units</u> Total units: 1400 Owner-occupied units: 1260 Vacancy rate: 2 percent Average sale price: \$40,000 Average monthly rent: \$300 <u>Multi-Family Units</u> There are eight multi-family units in Walters and thirty-two units of public housing. There are no vacancies in either type of unit. Average monthly rent: \$150 (1980 data)	PUBLIC SCHOOLS <u>1 Elementary School (grades K through 6)</u> 1980 enrollment: 431 Enrollment capacity: at capacity <u>1 Junior High School (grades 7 through 9)</u> 1980 enrollment: 206 Enrollment capacity: at capacity <u>1 High School (grades 10 through 12)</u> 1980 enrollment: 187 Enrollment capacity: at capacity (1980 data)	<u>Doctors</u> Total: 2 Ratio: 1/1500 <u>Dentists</u> Total: 1 Ratio: 1/3000 <u>Health Care Facilities</u> 1 Nursing home 51 beds (1978 data)	<u>Public</u> 2 Municipal parks 1 Swimming pool 2 Lighted tennis courts 1 9-hole golf course 2 Softball fields 1 Library Fairgrounds <u>Private</u> 1 Bowling alley (1980 data)	<u>Electric</u> Walters Electric Light and Water Department Source of supply: Southwest Power Administration Supply: Adequate Heating Fuels Source of product: Natural gas from Lone Star Gas Company Supply: Adequate 2 Propane distributors <u>Water Supply</u> Source: Lake Boyer and six wells Treatment plant capacity: 2.8 x 10 ⁶ Lpd (0.75 x 10 ⁶ gpd) Average daily consumption: 1.7 x 10 ⁶ L (0.45 x 10 ⁶ gal) Peak daily consumption: 2.3 x 10 ⁶ L (0.6 x 10 ⁶ gal) Storage capacity: 2.8 x 10 ⁶ L (0.75 x 10 ⁶ gal) Type of treatment: Chemical <u>Sewage Disposal</u> Municipal sewage disposal plant Design capacity: 1.7 x 10 ⁶ Lpd (0.45 x 10 ⁶ gpd) Average daily flow: 0.76 x 10 ⁶ L (0.2 x 10 ⁶ gal) Type of treatment: Trickling filter/digester <u>Solid Waste</u> Municipal landfill (1978 data)

FORT SILL, OKLAHOMA
TERRAIN ANALYSIS



OFF-POST FEATURES

- Urban area
- Airfield
- Cantonment area

Prepared by Dames & Moore, Washington, DC, under the direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1980.

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92. **RECREATION AND BUILT-UP SITES.** Scale approximately 1:50,000. No date. Directorate of Plans and Training, Fort Sill, OK. (II G)

93. [Slope Map of Fort Sill, OK]. Scale 1:50,000. 1980. (Unpublished overlay). Prepared by Dames & Moore, Washington, DC, for U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center, Fort Belvoir, VA. (II A, D, I, J)

94. **SPORTSMANS MAP, FORT SILL, OKLAHOMA.** Scale 1 inch = 1 mile. No date. Directorate of Facilities Engineering, Fort Sill, OK. (II B)

95. **TECTONIC MAP OF OKLAHOMA.** Scale 1:750,000. 1956. J. Kaspar Arbenz. Oklahoma Geological Survey, Norman, OK. (II F)

96. **TECTONIC MAP OF THE UNITED STATES.** Scale 1:2,500,000. 1962. American Association of Petroleum Geologists and U.S. Geological Survey, Washington, DC. (II F)

97. **TOPOGRAPHIC MAP, ARBUCKLE HILL QUADRANGLE, OKLAHOMA.** Scale 1:24,000. 1949, photo inspected 1975. U.S. Geological Survey, Washington, DC. (II J, L)

98. **TOPOGRAPHIC MAP, ELGIN QUADRANGLE, OKLAHOMA.** Scale 1:24,000. 1949 to 1956, photo inspected 1975. U.S. Geological Survey, Washington, DC. (II J, L)

99. **TOPOGRAPHIC MAP, FORT SILL QUADRANGLE, OKLAHOMA.** Scale 1:24,000. 1949 to 1956, photo revised 1975. U.S. Geological Survey, Washington, DC. (II J, L)

100. **TOPOGRAPHIC MAP, MOUNT SCOTT QUADRANGLE, OKLAHOMA.** Scale 1:24,000. 1949, photo inspected 1975. U.S. Geological Survey, Washington, DC. (II J, L)

101. **TOPOGRAPHIC MAP, ODETTA QUADRANGLE, OKLAHOMA.** Scale 1:24,000. 1950 to 1956. U.S. Geological Survey, Washington, DC. (II J, L)

102. **TOPOGRAPHIC MAP, QUANAH MOUNTAIN QUADRANGLE, OKLAHOMA.** Scale 1:24,000. 1949 to 1956, photo revised 1975. U.S. Geological Survey, Washington, DC. (II J, L)

103. **TRAINING AREA, FORT SILL.** No scale. No date. Directorate of Plans and Training, Fort Sill, OK. (II G)

104. **U.S. ARMY FIELD ARTILLERY CENTER AND FORT SILL.** Scale 1:9600. 1980. Directorate of Facilities Engineering, Fort Sill, OK. (II K)

105. **THE VEGETATION OF OKLAHOMA.** Scale 1:4,100,000. 1931. W.E. Brunex. Ecological Monographs 1:99-188. (II G)

AERIAL PHOTOGRAPHY

106. [Black and white contact prints]. Scale 1:20,000. February-March 1979. Available from Defense Mapping Agency Hydrographic and Topographic Center, Washington, DC, Project 78-4. (II A, D, E, G, I, J, L)

PERSONAL COMMUNICATIONS

107. Mr. Robert Adair. May 1980. Chief, Buildings and Grounds, Directorate of Facilities Engineering, Fort Sill, OK. Interview concerning bridges and fords.

108. Major Adamson. 10 June 1980. Chief of Training Branch, Directorate of Plans and Training, Fort Sill, OK. Interview concerning vegetation.

109. Mr. Lowell Ambrose. June - July 1980. Operations Division, USACC, Fort Sill, OK. Interview concerning telecommunications.

110. Mr. Steve Anschutz. May - August 1980. Environmental and Natural Resources Conservation Division, Directorate of Facilities Engineering, Fort Sill, OK. Interviews and telephone conversations concerning water, geology, vegetation, lines of communication, and non-urban culture features.

111. Mr. Ash. June - July 1980. Real Property Office, Directorate of Facilities Engineering, Fort Sill, OK. Telephone conversations concerning the cantonment area.

112. Mr. Jack Atchley. 17 June 1980. Superintendent, Duncan Public Schools, Duncan, OK. Telephone conversation concerning schools in Duncan.

113. Mrs. Barber. 7 July 1980. Bachelor Housing Office, Housing Division, Directorate of Facilities Engineering, Fort Sill, OK. Telephone conversation concerning guest houses.

114. Mr. Rex Beall. May 1980. Deputy Director, Directorate of Industrial Operations, Fort Sill, OK. Interview concerning lines of communication.

115. Mr. Guy Beasley. 18 June 1980. Deputy Base Civil Engineer, Altus Air Force Base, OK. Interview concerning the airfield.

116. Mr. Don Berry. May - June 1980. Operations Manager, Public Service Company of Oklahoma, Lawton, OK. Letters and telephone conversations concerning powerlines on Fort Sill.

117. Mr. Terry E. Beydler. May - September 1980. Public Works Director, City of Lawton, OK. Letters and telephone conversations concerning pipelines across Fort Sill and utilities and services in Lawton.

118. Ms. Bishop. 17 June 1980. Gregston Nursing Home, Marlow, OK. Telephone conversation concerning the nursing home.

119. Mr. Blackburn. May 1980. Range System Foreman, Directorate of Communications - Electronics, Fort Sill, OK. Interview concerning range communication and telephone lines.

120. Mr. Kermit Brandt. June 1980. Network Service Supervisor - OSP Engineering, Southwestern Bell Telephone Company, Lawton, OK. Letter and telephone conversation concerning telephone lines on Fort Sill.

121. Mr. John Bransford. July 1980. Contract Representative, Arkansas-Louisiana Gas Company, Shreveport, LA. Telephone conversations concerning natural gas on Fort Sill.

122. Ms. Cheryl Brawley. 11 June 1980. Educational Services, Directorate of Community and Personnel Activities, Fort Sill, OK. Telephone conversation concerning continuing education on Fort Sill.

123. Mr. Clifton A. Burris. May 1980. Administrative Assistant to the Manager, Transmission Engineering, Western Farmers Electric Cooperative, Anadarko, OK. Letter and telephone conversation concerning powerlines on Fort Sill.

124. Mr. Daryl Cagle. May 1980. Chief, Range Division, Directorate of Plans and Training, Fort Sill, OK. Interviews concerning ranges on Fort Sill.

125. Ms. Dee Calvert. 17 June 1980. Administrative Office, Talley-Walker Hospital and Clinic, Marlow, OK. Telephone conversation concerning the hospital.

126. Mr. Jim Carver. 17 June 1980. Sewer and Water Department, City of Duncan, OK. Interview concerning utilities and services in Duncan.

127. Mr. Chapman. June 1980. Registrar's Office, Cameron University, Lawton, OK. Telephone conversation concerning enrollment and programs at the university.

128. Ms. Lee Cornelius. 17 June 1980. Parks and Recreation Department, City of Duncan, OK. Interview concerning recreational facilities in Duncan.

129. Captain John P. Cotton. May 1980. Airfield Operations Branch, Aviation Division, Henry Post Army Airfield, Fort Sill, OK. Interview concerning fuel trucks at the airfield.

130. Mr. Wayne Couser. 20 June 1980. Airport Manager, Wichita Falls Municipal Airport, Wichita Falls, TX. Interview concerning the airfield.

131. Mr. Earl Culley. 17 June 1980. Public Works Director, City of Marlow, OK. Interview concerning utilities and services in Marlow.

132. Mr. Glen Dosser. 12 June 1980. Assistant Superintendent, Lawton Public School System, Lawton, OK. Telephone conversation concerning school enrollments and capacities for Fort Sill and the City of Lawton.

133. Ms. Adrian Drew. 13 June 1980. Secretary to the Superintendent, Chickasha Public Schools, Chickasha, OK. Interview concerning the school system.

134. Mr. Ray Duffy. 16 June 1980. Utility Superintendent, City of Frederick, OK. Interview concerning utilities and services in Frederick.

135. Mr. Paul E. Fisher. 17 June 1980. Planner, Association of South Central Oklahoma Governments, Duncan, OK. Interview and literature concerning off-post urban areas.

136. Mr. Owen Fry. 16 June 1980. Mayor, City of Frederick, OK. Interview concerning Frederick.

137. Captain Walter Garner. 18 June 1980. Chief of Engineering, Altus Air Force Base, OK. Interview concerning the airfield.

138. Mr. Lloyd Goombi. May 1980. Drafting Supervisor, Engineering Services Branch, Directorate of Facilities Engineering, Fort Sill, OK. Interview and materials concerning lines of communication and non-urban culture features.

139. Ms. Gordon. 12 June 1980. Secretary to the Superintendent, Lindsay Independent School District, Lindsay, OK. Interview concerning the school system.

140. Mr. Fred Hanberger. May 1980. Superintendent, Arkansas-Louisiana Gas Company, Lawton, OK. Telephone conversation concerning gaslines across Fort Sill.

141. Mr. Julius Haralson. 13 June 1980. Chickasha Planning Commission, Chickasha, OK. Interview concerning Chickasha.

142. Mr. John Hawk. May 1980. Assistant Chief, Buildings and Grounds, Directorate of Facilities Engineering, Fort Sill, OK. Interview concerning bridges.

143. Mr. Jim Hay. 17 June 1980. Housing Office, City of Duncan, OK. Interview concerning housing in Duncan.

144. Ms. Jill Hensley. 19 June 1980. Office of the Superintendent, Burkburnett Independent School District, Burkburnett, TX. Telephone conversation concerning the school system.

145. Mr. Ben Honea. 11 June 1980. Counselor, Educational Services, Directorate of Personnel and Community Activities, Fort Sill, OK. Telephone conversation concerning vocational technical programs on Fort Sill.

146. Mr. Don Howland. 17 June 1980. Electric Department, City of Duncan, OK. Interview concerning electric utilities in Duncan.

147. Mr. Mike Hubbard. June 1980. Coordinator, Oklahoma Health Systems Agency, Lawton, OK. Telephone conversation and literature concerning medical facilities in off-post urban areas.

148. Mr. C.D. Hutton. June 1980. Electrical Branch, Utilities Division, Directorate of Facilities Engineering, Fort Sill, OK. Telephone conversation concerning powerlines.

149. Ms. Pat Jones. 7 August 1980. Kuntry Realty, Frederick, OK. Telephone conversation concerning housing in Frederick.

150. Mr. Kilgus. 11 June 1980. Maintenance Coordinator, Logistics Division, U.S. Army MEDDAC, Fort Sill, OK. Interview concerning medical facilities.

151. Mr. Donald King. June - July 1980. Director, Morale Support Activities, Fort Sill, OK. Interview and telephone conversation concerning recreational facilities.

152. Mr. Wayne Kiser. May - June 1980. Chief, Utilities Division, Directorate of Facilities Engineering, Fort Sill, OK. Interviews concerning pipelines, powerlines, and Fort Sill's electrical system.

153. Mr. Harold Ledford. May - June 1980. Assistant Chief, Utilities Division, Directorate of Facilities Engineering, Fort Sill, OK. Interviews concerning pipelines and utilities.

154. Mr. Jerry Lemons. 19 June 1980. President, Chamber of Commerce, Walters, OK. Interview concerning Walters.

155. Mr. William Lewis. May - June 1980. Chief, Sanitation Branch, Directorate of Facilities Engineering, Fort Sill, OK. Interviews concerning utilities, water supply, and sewerage systems.

156. Mr. Marshall Long. 17 June 1980. Planning Commission, Marlow, OK. Interview concerning Marlow.

157. Mr. Ron Martin. May 1980. Supervisor of Engineering Services, Cotton Electric Cooperative, Walters, OK. Letter and telephone conversation concerning powerlines on Fort Sill.

158. Ms. Linda Matthews. 16 June 1980. Office of the Superintendent, Frederick Independent School District, Frederick, OK. Telephone conversation concerning the school system.

159. Mr. Rick McKinney. 12 June 1980. City Manager, City of Lindsay, OK. Interview concerning Lindsay.

160. Ms. Jenill McLean. 17 June 1980. Duncan Regional Hospital, Duncan, OK. Telephone conversation concerning the hospital.

161. Ms. Gwen Meggs. 23 June 1980. Secretary, Airport Manager's Office, Wichita Falls Municipal Airport, Wichita Falls, TX. Letter concerning the airport.

162. Captain Meredith. May 1980. Deputy Commander, Airfield Operations Branch, Aviation Division, Henry Post Army Airfield, Fort Sill, OK. Interview concerning the airfield.

163. Mr. Hal Miller. 16 June 1980. Administrator, Tillman County Memorial Hospital, Frederick, OK. Interview concerning the hospital.

164. Ms. Billie Mixon. 17 June 1980. Marlow Manor, Marlow, OK. Telephone conversation concerning the nursing home.

165. Mr. Al Morgan. 27 August 1980. Field Utility Superintendent, Public Works Department, City of Lawton, OK. Telephone conversation concerning underground waterlines across Fort Sill.

166. Ms. Marie Muse. 18 June 1980. Office Manager, Chamber of Commerce, Hobart, OK. Interview concerning Hobart.

167. Mr. Billy Newell. 13 June 1980. Public Works Director, City of Anadarko, OK. Interview concerning utilities and services and recreational facilities in Anadarko.

168. Mr. Ross Nixon. 13 June 1980. Assistant Superintendent, Anadarko Public School System, Anadarko, OK. Interview concerning the school system.

169. Mr. James Nury. June - July 1980. Arkansas-Louisiana Natural Gas Company, Lawton, OK. Telephone conversation concerning natural gas supply for Fort Sill and surrounding urban areas.

IV. LIST OF SOURCES (Continued)

170.

Mr. Scott Ousley. 17 June 1980. Superintendent, Marlow Public Schools, Marlow, OK. Telephone conversation concerning the school system.

171.

Mrs. Parker. May 1980. POL Section, Supply Division, Directorate of Industrial Operations, Fort Sill, OK. Telephone conversation concerning airfield POL facilities.

172.

Mr. Robert L. Perkins. 26 June 1980. Superintendent, Walters Public Schools, Walters, OK. Letter concerning the school system.

173.

Ms. Katy Phelps. 7 August 1980. Washita Valley Community Action Council, Chickasha, OK. Telephone conversation concerning housing in Chickasha.

174.

Mr. Lee Potts. 19 June 1980. President, Chamber of Commerce, Burkburnett, TX. Interview concerning Burkburnett.

175.

Ms. Alice Redwine. 1 August 1980. Secretary, Administrative Office, Grady Memorial Hospital, Chickasha, OK. Telephone conversation concerning the medical center complex.

176.

Ms. Elizabeth Rochel. 17 June 1980. Red River Area Vocational Technical School, Duncan, OK. Telephone conversation concerning the school.

177.

Mr. Serge Saltiel. May - June 1980. Master Planning Branch, Directorate of Facilities Engineering, Fort Sill, OK. Interviews and telephone conversation concerning buildings on Fort Sill.

178.

Ms. Gwen Smith. 16 June 1980. Office Manager, Lone Star Gas Company, Frederick, OK. Interview concerning natural gas supply in off-post urban areas.

179.

Mr. Wheeler Smith. 20 June 1980. Environmental Planning Office, Sheppard Air Force Base, TX. Interview concerning the airfield.

180.

Mr. Joseph Steele. 11 June 1980. Army Community Service Branch, Directorate of Personnel and Community Activities, Fort Sill, OK. Telephone conversation concerning preschool and child care on Fort Sill.

181.

Mr. Wayne Stenis. 12 June 1980. City Planner, City of Lawton, OK. Interview concerning Lawton.

182.

Mr. Jess Storts. May 1980. Vice President - Production, Westheimer-Neustadt Corporation, Ardmore, OK. Letters and telephone conversations concerning gas wells and underground gas-lines on Fort Sill.

183.

Ms. Helen Thurman. 19 June 1980. City Clerk, City of Walters, OK. Interview concerning Walters.

184.

Ms. Luwayne Tyner. 11 June 1980. Family Housing Office, Directorate of Facilities Engineering, Fort Sill, OK. Interview concerning family housing.

185.

Mr. Vankuiken. May 1980. Engineer, Chicago, Rock Island, and Pacific Railroad, Chicago, IL. Telephone conversation concerning the railroad.

186.

Mr. Buddy Veltema. 19 June 1980. City Manager, City of Walters, OK. Interview concerning utilities and services in Walters.

187.

Mr. George Wallace. 10 June 1980. Real Property Office, Directorate of Facilities Engineering, Fort Sill, OK. Interview concerning buildings on Fort Sill.

188.

Ms. Oralena Wampler. 19 June 1980. Broker, Wampler Real Estate Company, Burkburnett, TX. Interview concerning housing in Burkburnett.

189.

Mr. Pat Warner. 11 June 1980. Electrical Branch, Utilities Division, Directorate of Facilities Engineering, Fort Sill, OK. Interview concerning the electrical system on Fort Sill.

190.

Mr. Bob Wilkerson. 13 June 1980. Grants Manager, City of Anadarko, OK. Interview concerning housing and medical facilities in Anadarko.

191.

Ms. Rita Williams. 12 June 1980. Office Manager, Public Service Company of Oklahoma, Lawton, OK. Interview concerning service provided to off-post urban areas.

192.

Mr. Charles York. 25 August 1980. Engineer, St. Louis-San Francisco Railroad, Tulsa, OK. Telephone conversation concerning the railroad.

193.

Mr. Andy Zunich. 16 June 1980. Airport Manager, Lawton Municipal Airport, Lawton, OK. Literature concerning the airfield.

194.

Chamber of Commerce, Burkburnett, TX. 19 June 1980. Literature concerning Burkburnett.

195.

Evergreen Manor Nursing Home, Burkburnett, TX. 19 June 1980. Telephone conversation concerning the nursing home.

196.

Parkview Nursing Home, Walters, OK. 19 June 1980. Telephone conversation concerning the nursing home.